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Witherbee-Sherman No. 3 Magnetic Mill

By S. L. Nason*

SYNOPSIS—This concentrating mill handles a magnetite ore running 40 to 50% iron. Dry crushing and magnetic separators used. Three types of latter: Drum machines, pulley machines and belt machines. A 2-in. concentrate product made on cobbing drums and a 2-in. tailing rejected by pulley machines. Mill driven in two sections by separate motors, so that either half may be run alone.

Witherbee, Sherman & Co.'s No. 3 mill is located between shafts "A" and "B" of the Harmony mine, at Mineville, N. Y. The building is 156 ft. long by 54 ft. wide by 50 ft. high, built of concrete and steel. The walls are laid with concrete blocks 20x10x8 in., of the company's own make; the aggregate is the tailings from the mills from ¼ in. down, making an excellent concrete.

No. 3. Separator. Note Conveyor House from "B" Shaft on Left, with Cylindrical Storage Bin and Concentrates Bin on Right. Courtesy of "General Electric Review"

Conveyors and Bins

The ore sent to the mill is of 40 to 50% magnetic iron, occurring in a hard gneiss rock composed of feldspar and quartz and of more or less hornblende. The mill makes a 97% recovery on this ore. The mine ore, running from 18 in. to 16-mesh, passes through preliminary breakers at the shaft houses. At "A" shaft a No. 8 gyratory crusher is used, and at "B" shaft, a Blake 18x36-in. jaw crusher; both machines break to about a 4-in. size. From each crusher the ore is conveyed to the storage bin at one end of the mill by 20-in. Robbins conveyors that form "B" shaft, being about 330 ft. long, that form "A" shaft, 222 ft. The ore is weighed as it passes on the conveyors by Merrick weightometers.

The mill storage bin has a capacity of 1000 long tons; it is cylindrical, 25 ft. in diameter by 50 ft. high, built of concrete with vertical and horizontal reinforcing of 1⅛-in. discarded hoisting rope. The mill will handle about 100 tons per hr., starting with 400 to 500 tons in the bin and cleaning up in nine hours' run the bin and the mine product for that shift, the latter being about 400 to 500 tons.

From the bottom of the storage bin the ore is drawn through an adjustable feed gate by a shaking feeder, consisting of a pan 9 ft. long by 3 ft. wide with 18-in. sides.

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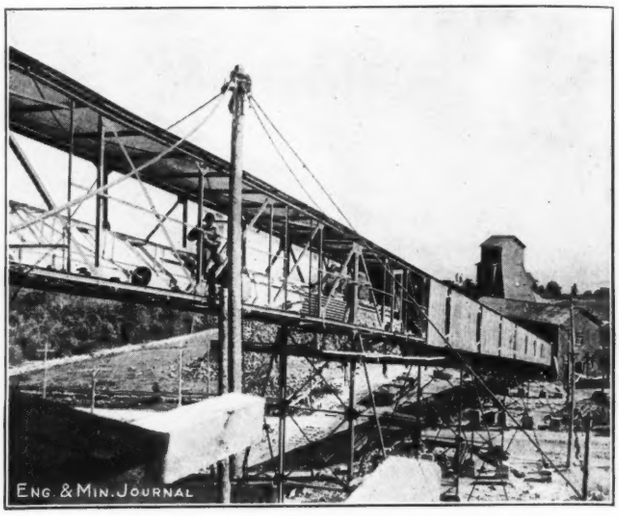
The feeder is slung from overhead by two suspension rods on the back end, and on two rocker-arms in front, and is driven by an eccentric with a 2-in. throw. The feeder discharges into a 30-in. belt elevator using 30-in. buckets bolted to a 32-in. eight-ply belt. The elevator is 61 ft. center to center and inclined 71° from the horizontal.

The bucket belt has a speed of 240 ft. per min., giving the elevator a maximum capacity of 564 tons per hour. From the elevator the ore is discharged into two screens 40 in. in diameter by 15 ft. long, of the heavy-trommel type. The screen plate is in three 5-ft. sections ⅜ in. thick with 2-in. perforations. The material passing over these screens falls through chutes into two No. 6 gyratory crushers running at 325 r.p.m. These crushers are located one each side and above the shaking feeder, so that the material crushed runs directly into the shaking feeder and is taken back to the screens with the main feed.

The Cobbing Drums

The material which passes through the screens falls through box chutes to two Norton cobbing drums, 30 in. in diameter by 18-in. face and running at 56 r.p.m. These machines are used as preliminary separators to keep the free iron from being ground finer and overloading the machines throughout the mill. The two machines pick iron from 16-mesh to through 2 in. in size and throw off from 20 to 30 tons per hr., which is sent directly to the concentrate shipping bin. The concentrates analyze from 60 to 63% iron and 9% silicon.

Considerable range in the grade of concentrates is made by raising or lowering the current through the magnets, four amperes being used on these machines at the head

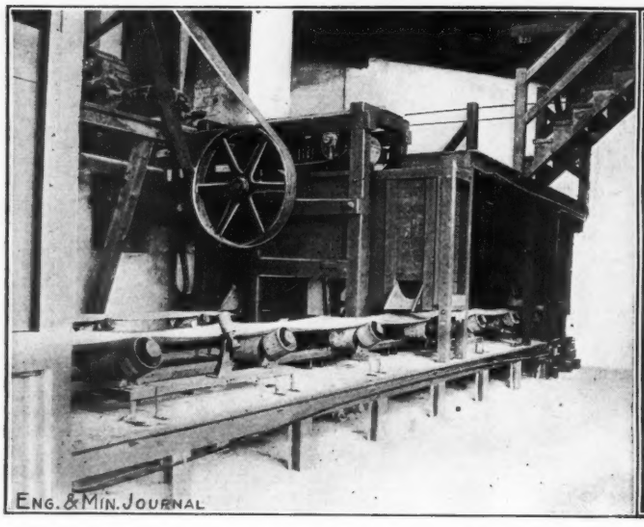


Conveyor House from "B" Shaft to Mill

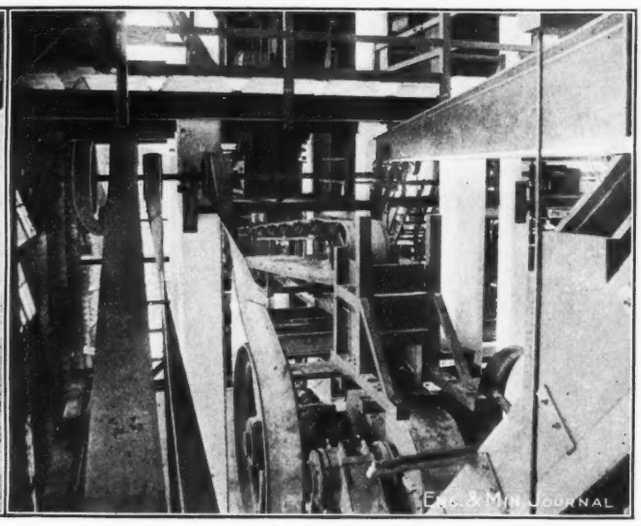
end of the mill and seven amperes on similar machines in the further course of separation.

Pulley Machines

The middlings or rejects from these machines drop through a chute to a 20-in. conveyor belt, the head pulley



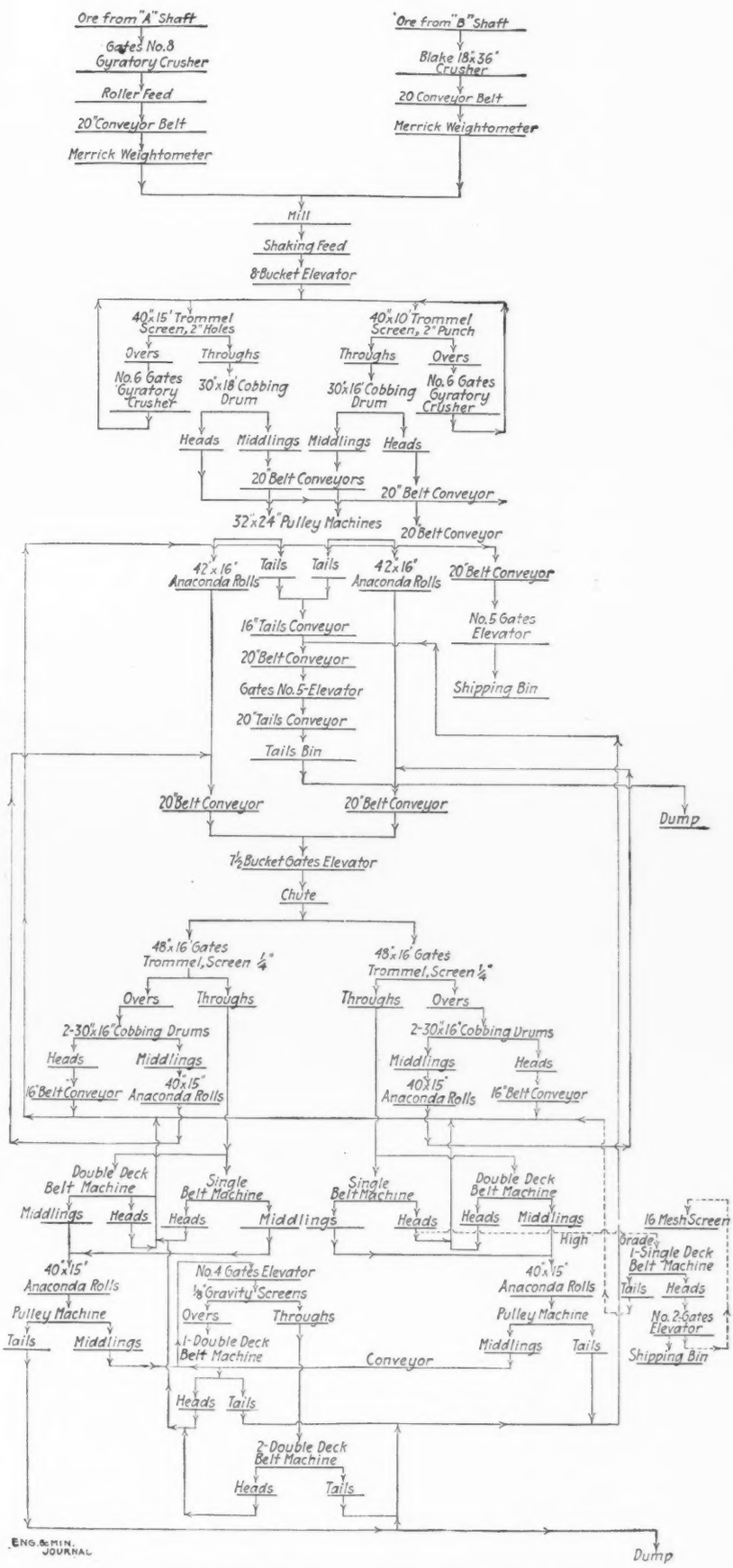
Belt Separator in Two Banks with Concentrates and Tailings Conveyors



Mill Interior Showing Concrete Pillars and Steel Floor Beams

The drum machines are simply cylindrical brass drums with a rubber-covered protecting face revolving about a stationary yoke to which the magnets, sixteen in number, are attached. The magnets are connected eight in series and two in parallel in each series which gives a sifting movement to the ore in passing over the drum, tending to drop the middlings and tailings from the richer ore. A division board is set in such a manner that a suitable separation is made and the yoke is placed so that the concentrates are lifted above the division board and as they pass from the influence of the magnets fall to one side, while the middlings fall on the opposite side of the board.

of which is an electro-magnet of the pulley-machine type. This also is a drum with an inside yoke to which are fastened 24 magnets, but these, instead of being stationary, revolve with the shaft. These machines carry 25 amp. and are run at 50 r.p.m., giving a belt speed of about 319 ft. per min. They make tailings of a 2-in. size, which run about 8% in iron; it proves economical to throw out this material before it reaches the rolls. The middlings from these machines are held on the magnets until the conveyor belt pulls them from their influence; it then drops them into two sets of 42x16-in. spring rolls, where they are crushed to 1 in. and less.



FLOW SHEET OF WITHERBEE-SHERMAN NO. 3 MILL

The product from the rolls is conveyed to No. 2 elevator, which uses 24-in. buckets, bolted to a 26-in. eight-ply belt. This, like the first elevator, is 61 ft. center to center of head and tail pulleys, and is also inclined 71°. This elevator has a belt speed of 230 ft. per min., and a capacity of 330 tons per hr. From the elevator, the feed passes into two 40-in. by 16-ft. trommel screens of ⅜-in. punched-steel plate, 1-in. perforations, circumscribed with jackets of $\frac{3}{16}$-in. punched-steel plate, having ⅛-in. perforations. The oversize from the 1-in. screen passes through a chute to two 40x15-in. rolls, crushing to ¼ in. and runs from these back to the No. 2 elevator.

The product through 1 in. passes over cobber drums, four in number, similar to those described above but carrying seven amperes on the magnets. The concentrates pass to the shipping bin with the concentrates from the two cobber drums at the head end of the mill; the rejects pass through the two sets of 40x15-in. rolls handling the oversize from the 1-in. screen; the oversize from the ¼-in. jackets joins the throughs from the 1-in. screen and passes over the cobbers. The throughs from the ¼-in. dust jackets furnish the feed for the first belt machines in the mill, this feed running from about ⅛ in. maximum size down to through 16-mesh.

THE BELT MACHINES

The belt machines are built double on 5x5-in. Georgia-pine frames one machine above the other; each consisting of a 26-in. feed roll, 10 in. in diameter, running at 20 r.p.m., delivering to a feed belt, 26 in. wide, running at 196 ft. per min. Directly over the feed belt is the take-off belt of the same width as the feed belt, but running at 361 ft. per min. The magnets, 12 in number, are suspended between the advance and return of the take-off belts and carry from 5 to 10 amp., according to the quality of concentrates desired. They are connected so that six magnets are positive and six are negative poles, or every other pole is negative, giving a sifting action to the particles as they fly up from the feed belt to the take-off belt and thus separating the middlings from the pure ore. The belts are simply two short nontroughing conveyor belts 26 in. wide and about 4 ft. long. The tails from the first six of these belt machines are sent through two 40x15-in. choke-feed spring rolls and ground to ⅛ in. and under, elevated and passed over a

⅛-in. gravity screen, the throughs being treated by four belt machines, the overs by two belt machines. The tailings go directly to the tailings pile and the concentrates to the shipping bin.

Summarized Equipment and Power

The total crushing equipment is one Blake jaw crusher, 18x36 in., one No. 8 gyratory, two No. 6 gyratories, two sets of 42x16-in. rolls and four sets of 40x15-in. rolls. The separating equipment is six Ball & Norton single-drum machines, four Norton pulley machines and 12 Ball & Norton belt machines.

The power is belt-and-shaft transmitted from two 150-hp. alternating-current motors; the direct current for separators and lights is obtained from a 50-hp. motor-generator set. The drives are so laid out that one side of the mill may be run independently of the other. A glance at the accompanying flow sheet will give a good idea of the layout of the machinery.

Copper Leaching

We have mentioned several times, the great interest at present exhibited in the hydrometallurgy of copper and the large amount of experimental work that is going on. Some of this has, indeed, advanced so far that constructions of commercial plants are in progress. This article is intended to be merely a catalog, probably incomplete, of what is being done.

Arizona Copper Co.—This company has, for many years, used a leaching process, consisting of sulphuric-acid lixiviation and precipitation by scrap iron, for the treatment of some of its ore. Experiments on the treatment of the slime from the concentrating mills are now being conducted. Nothing has yet been published respecting their nature. The important feature in the old process is understood to be precipitation from neutral solution.

Anaconda—Frederick Laist, superintendent of the Washoe works, has developed a process, which is now being tried out in a plant of 80-tons daily capacity.

The plant consists of a 20-ft. MacDougal roaster; two leaching tanks, 32 ft. in diameter, by 12 ft. deep, and the necessary auxiliary apparatus. The process, designed chiefly to treat tailings, roasts the ore, after which 1% of salt is added and a chloridizing roast given.

Leaching will be done with sulphuric acid, to be made eventually from the roast gases. Precipitation at first will be on scrap iron, but experiments will also be conducted with iron sponge, produced by the reduction of iron ore, and with electrolytic and hydrogen-sulphide precipitation.

Braden—The concentrates are roasted in such a manner as to eliminate practically all the sulphur and at the same time oxidize all iron to the ferric state. The roasted product is then leached with dilute sulphuric acid in two stages—a neutralizing leaching, and an acid leaching. The solution from the neutralizing leaching is electrolized directly, and that from the acid solution is neutralized by the following batch of calcines. The development of this process, and also the Chuquicamata process (to be referred to subsequently) has been done under the direction of E. A. Cappelen Smith.

Bradley—Charles S. Bradley, backed by A. C. Burrage and Thomas W. Lawson, erected a plant at Anaconda, Mont., to treat the slime from the Washoe concentrator by the ingenious Bradley process, which consists in sulphate-roasting, leaching with calcium-chloride solution, and precipitation of copper from chloride solution by means of calcium oxide, regenerating calcium chloride which is used as lixiviant. When tried at Bayonne, N. J., this process is said to have worked well, but at Anaconda difficulties were experienced, and after a large sum of money had been expended and only a few hundred tons of ore had been treated the plant was closed. However, Mr. Bradley has great confidence in his process and hopes to resume work at Anaconda.

Butte & Duluth—This company has a deposit of decomposed granite mineralized with oxidized copper, close to Butte, Mont. The ore is being leached with dilute sulphuric acid and copper deposited from the solution by electrolysis in the main, but foul solutions are switched off for precipitation by means of scrap iron. The plant is of something like 100 tons daily capacity and is being run on commercial basis. Its arrangements are rather crude, but the ore appears to give a fairly good extraction even when leached in relatively coarse condition in V-shaped vats. According to newspaper reports the capacity of the plant is to be increased.

Bullwhacker—This company, at Butte, has ore similar to that of the Butte & Duluth company, and is treating it in a similar way. This also is a commercial plant, operating on a small scale.

Chuquicamata—The ore is a brochantite ore, crushed to from ¼- to ½-in. mesh, leaching with dilute sulphuric acid in large open tanks, draining the leached solution, electrolyzing with insoluble anodes, and returning the electrolyzed solution for further leaching. Owing to the SO_3 in the brochantite, there is a gain in sulphuric acid in the process.

Copper Queen—Experimental work is being conducted at Douglas, Ariz., by G. D. Van Arsdale, on the treatment of the low-grade porphyry ore of the Copper Queen mines. He roasts the ore, leaches with dilute sulphuric acid, and electrolyzes the copper solution, injecting sulphurous acid into the electrolyte for its regeneration and for reduction of the electric energy required.

Cornelia—The Calumet & Arizona company recently acquired the Cornelia mine, in the Ajo Mountains, southwestern Arizona, which has a large body of oxidized ore. Stuart R. Croasdale and Utley Wedge, inventor of the Wedge furnace, are conducting experiments. They are said to mix some pyrites with the ore, roast, leach with sulphuric acid and electrolyze the solution. It is reported that a plant of 250 tons daily capacity is shortly to be erected. The present idea seems to be to precipitate with iron.

Henderson—The Pennsylvania Salt Manufacturing Co., at its works at Greenwich Point (Philadelphia), and at Natrona (near Pittsburgh), for upward of a quarter of a century has been treating Rio Tinto pyrites by the beautiful Henderson process. This process is especially adapted for the extraction of copper from burned pyrites. It is minutely described in "The Mineral Industry," Vols. VIII and IX. The process remains practically unchanged today, except that Wedge muffle furnaces have been substituted for the old straight-line, hand-rabbled furnaces and the single-hearth, circular, mechanical furnace. The Wedge furnace is, of course, a substantial improvement. Both at Greenwich Point and at Natrona the copper is precipitated by means of scrap iron. The cement copper is shipped to electrolytic refiners.

Inspiration—Professors Duncan and Bacon, of the University of Pittsburgh, are conducting experiments for this company, which has ore of character similar to that of the Keystone mine, which has part of the same orebody. The nature of their experiments has not yet been disclosed.

Keystone—At Miami, Ariz., R. C. Canby is working with an experimental plant of about 20 tons daily capacity on the mixed sulphide-carbonate ore of the Keystone mine. The main lines of his work are similar to those of Mr. Van Arsdale, at Douglas.

Shannon—J. W. Bennie, the manager of this company, at Clifton, Ariz., has been working upon a leaching process for a couple of years or more, assisted by F. S. Schimerka. The process consists in roasting the oxidized ores, which are extremely basic, with pyrite, in order to sulphatize the copper. The spent liquor from the precipitation plant is also poured over the roast heap to assist in this. The leaching is by water and the copper precipitated from solution on scrap iron.

Snowstorm—This company, near Mullan, Idaho, for several years (about 1907 and later) operated a leaching mill for the treatment of some of its ores. Extraction of copper was effected by sulphuric acid and precipitation by means of scrap iron. Lately the plant has been idle.

Rhyolite and Virginia

A writer in the *Saturday Evening Post* tells some reminiscences that are more true to life than such contributions usually are: Here are some excerpts: When the bottom dropped out of the market the bottom dropped out of the banks too. And there was another reason: the country, in the language of a wise old desert-rat friend of mine, was "ripe for a trimming."

"They been a-flyin' too high, doc," said he. "They're due to come down; so get from under. The stuff ain't in the ground, I tell you; and when the old high-grade ain't in the bowels of the earth you can't pump it in with hot air or shoot it in with printer's ink. Play her for a bust, doc. This country is ripe for a trimming!"

The bubble, having reached its limit, did not explode at once; it began to dwindle in size and lose its bright coloring. Then the ingrown and incurable optimism of the inhabitants asserted itself.

"A bank or two has failed," said they; "why sure! What of that? Don't banks fail everywhere? This is nothing but a temporary setback—a slight depression. It'll be all right in a few days."

Rhyolite, they announced with a great deal of heat, was going to be another Tonopah—yes, even greater than Tonopah—and all the power of earth and air could not stop her. The slight depression they mentioned might resemble the bottomless pit to an outsider; but the darker the outlook the louder rose the boosting chorus. If expressions of confidence could have saved the camp it would have been saved a thousand times over. Those men were so thoroughly impregnated with the boosting spirit that they could not or would not recognize disaster.

About this time there rose a loud noise to the north of us. The camp of Rawhide was celebrating the first flush —we called it the fourflush—of its boom. The gamblers packed their paraphernalia and left us—and that was a bad sign, for the professional gambler always follows the money center.

Little by little the population of Rhyolite began to slip away. Men would not admit they were leaving the camp. They said they wanted to see what was doing at Rawhide —they made all sorts of excuses; but they did not come back.

I had some business that took me north and on the way I stopped at Rawhide. There were the same frame buildings, the same tents, the same crowds in the street, the same gamblers, the same brokers' offices, and the same blind eagerness to invest in anything that bore the name of a mine—it was Rhyolite in 1906 all over again.

The next day I reached Virginia City, and there I saw the other side of the picture. Virginia, as they call it in Nevada, was once the greatest silver camp the world has ever known. Out of the miles of workings underneath her steep streets came the millions that saved the credit of the nation during the Civil War. Dozens of the large fortunes of the present day were founded on the Comstock Lode.

The silver kings of the '60s built their city as if for all time, hauling in the materials by mule train. I was directed to a hotel; but there was no clerk behind the desk, no bellboy to take my satchel. I found myself alone in a spacious lobby where the furniture was hand-carved walnut or mahogany. The mirrors in their heavy frames reached halfway to the frescoed ceiling, from which hung tarnished chandeliers.

Everything about the place was massive, old-fashioned, and eloquent of the days when money was the commonest thing on the slope of Mount Davidson.

I was lost in the midst of this dusty magnificence until I heard a tapping, which seemed to proceed from the hotel office. At first I thought a woodpecker had taken possession of the premises; but on investigation I discovered an aged cobbler, who had turned the office into a shop. He was mending miners' boots, and the tap-tap-tap of his hammer rang hollowly in that lonesome place.

The cobbler pushed back his glasses and blinked at me curiously.

"Is it safe to leave my satchel here?" I asked.

"Safe enough," he said. "Nobody comes round here much. Jim will be back pretty soon and he'll take care of you."

The atmosphere of a vanished generation was depressing; so I went out and walked through the streets. On all sides were boarded windows, locked doors and dust-covered steps. It reminded me of Fifth Avenue in New York in the summertime; but I knew as I looked that the men who had locked these doors would not return for the winter—or any other season.

At dusk I came on three old men sitting on the edge of the sidewalk.

"How does the camp look?" I asked.

"Well," said one old fellow, "she's picking up a little—yes, sir, she shore is! Been pretty quiet for a long spell, but she'll get over that—give her time. She's picking up some—ain't she, boys?"

Thus appealed to, the others wagged their gray heads and nodded assent.

"She was a humdinger once!" said the spokesman. "Yes, sir; she was a looloo bird with a long tail, and she will be again when silver gets back to the right mark. If Dick Bland had lived—Well, she's picking up right along anyhow."

So there I found it again—the hopeless, ingrown optimism of the mining country, where no depression is

more than temporary and no decline is cureless.

I went back to the hotel and was guided upstairs by a decrepit Chinaman, who seemed childishly pleased to see a strange face. Perhaps that was why he asked me only a dollar for the use of a suite of rooms that, judging from the richness of their fittings, must have been reserved for bridal couples or the princes of the silver age.

I looked at the big four-poster bed, the marble-topped tables, and the thick, faded Brussels carpet. Surely here was the permanent camp if ever there was one; and there came to me a realization that stone and solid timbers do not make prosperity—nor can they hold it once it begins to slip away. The soul of Virginia City had been the men in it—and they were gone.

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Wages in the Michigan Copper District

The following table of wages paid in the Michigan copper country was made up by the strike investigating committee from the payrolls of the various mines:

SHIFTS WORKED AND EARNINGS OF MINERS AND TRAMMERS AT COPPER COUNTRY MINES, JAN. 1 TO JUNE 30, 1913

	Miners			Trammers		
Mine	Days	Amount	Av. Wages	Days	Amount	Av. Wages
A	19,447	$69,224.78	$3.56	17,769	$50,581.02	$2.85
B	13,473	48,533.81	3.60	15,844	43,208.28	2.73
C	33,367	115,380.62	3.46	29,029	92,001.39	3.17
D	72,241	264,984.87	3.67	52,790	153,216.35	2.90
E	1,450	4,639.94	3.20	1,045	2,610.98	2.50
F	4,767	16,615.39	3.49	4,504	12,181.10	2.70
G	367	933.53	2.54	169	429.01	2.54
H	30,059	94,003.75	3.13	20,099	51,394.70	2.57
I	106	425.10	3.98	237	582.72	2.46
J	873	2,846.42	3.26	238	587.94	2.46
K	17,104	61,319.73	3.59	20,311	51,645.06	2.54
L	12,032	36,420.82	3.03	13,403	34,095.84	2.54
M	11,502	39,520.34	3.44	10,924	27,762.13	2.54
N	1,692	5,77[illegible]81	3.42	665	1,539.23	2.31
O	6,701	23,798.71	3.55	4,642	14,564.15	3.14
P	17,417	58,617.22	3.37	14,692	40,614.45	2.76
Q	886	4,549.13	5.13	1,514	3,818.44	2.52
R	39,591	115,881.59	2.93	19,337	44,580.55	2.31
S	52,129	151,623.65	2.91	21,643	49,932.45	2.31
T	26,298	77,140.80	2.93	11,041	25,617.35	2.32
U	16,139	44,629.67	2.77	10,558	23,690.84	2.24
V	6,843	19,890.40	2.91	3,761	8,544.00	2.27
W	1,150	3,574.00	3.11	1,213	2,807.91	2.31
X	35,779	108,981.59	3.05	24,653	62,770.28	2.55
Y	1,796	5,088.55	2.83	618	1,458.90	2.36
Z	89,508	270,825.03	3.03	30,400	76,211.25	2.51
AA	14,072	43,869.77	3.12	13,709	32,694.05	2.38
BB	15,064	46,688.05	3.10	14,391	35,769.00	2.49
Total.....	541,860	$1,735,786.07	3.20	359,210	$944,909.38	$2.63

The conditions under which trammers work in the various mines differ greatly. In some mines where a large amount of rock is to be taken out from one level, it has been possible to install electric tramming, which means that the work of the trammer consists in loading the cars, which are then hauled to the shaft by electric motors. In other mines, where only a limited amount of rock is taken out at each level, it has been impracticable to establish power tramming and the cars are pushed to the shaft by the trammers. The problem of lightening the work of loading and pushing tram cars has been one that has caused considerable trouble. The average car trammed by two men holds 2½ tons of rock. The distance which it is required that trammers push the car varies, at different levels in the various mines, from 50 ft. to distances of 1500 or 1600 ft. The cars are of various types and trammers can be found who insist that each particular kind of car is the best. All the cars run on steel rails and the levels and the tracks are graded with a down grade toward the shaft in favor of the loaded car. The number of cars required to be taken out by men who work on day's pay varies with the varying conditions and the distances to be trammed.

Loading conditions also vary. In some cases the tram cars are loaded by shoveling from the floor of the drift, in some places they are loaded from chutes, and wherever possible a loading platform or sollar is constructed level with the top of the car so that the work of loading is minimized. In some instances the men push the cars a short distance, from which point the cars are hauled by electric or cable haulage. The tramming is done in many cases by contract and a comparison of the pay made by trammers working on day's pay with those working on contract shows that contract trammers make by far the biggest wages. At the same time they accomplish more work, and it has been found that the contract trammer who makes the biggest pay is also the best man for the operator. Contract trammers in the mines from which the committee has been able to obtain statistics tram on an average of 21 tons, while trammers working on company account or day's pay average from 12 to 14 tons.

In the Calumet & Hecla mine and its subsidiaries contract tramming is encouraged, as it is claimed that it results in higher wages, cheaper tramming and a much better class of trammers. As an illustration, at the Calumet & Hecla amygdaloid mine, where the tramming is entirely done by contract, the trammers' wages for the month of June, 1913, averaged $3.34 per shift as compared to $2.56 paid to trammers on day's pay.

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Charters Towers Deep Sinking

The application of Thomas Mills, of Charters Towers, Queensland, for a subsidy of £60,000, to sink a shaft 4000 ft. on Charters Towers, has had the consideration of the government, and the following board has been appointed to conduct an investigation and make a report on the proposal; John G. Linedale, warden, Charters Towers (chairman); W. H. Rands, consulting geologist to the Queensland government; and C. F. V. Jackson, chief inspector of mines. The board has been appointed to inquire into and report upon: (1) The proposal of Thomas Mills to sink 4000 ft. for the purpose of thoroughly exploring deep ground, carrying on the development on lodes, and making connections with Mills' United, Brilliant Deeps and other mines. (2) The probable cost of the shaft, equipment, exploration and connections of the undertaking. (3) The appropriateness of the method proposed. (4) The capital which would ensure completion of the proposal. (5) The probability of obtaining payable ore in sufficient quantities to yield a reward commensurate to the cost. (6) The advantages likely to be gained from (a) improved ventilation; (b) profitable working of large bodies of ore now unpayable; (c) more economic handling of heavy water, and (d) opening up a large tract of new country. (7) The probable date of completion of the various stages of the proposed work, and the time likely to elapse before the other mines will derive the advantages expected to result.

There is reason to hope that much of the old glory of Charters Towers as one of the gold-mining centers of the world will be revived.

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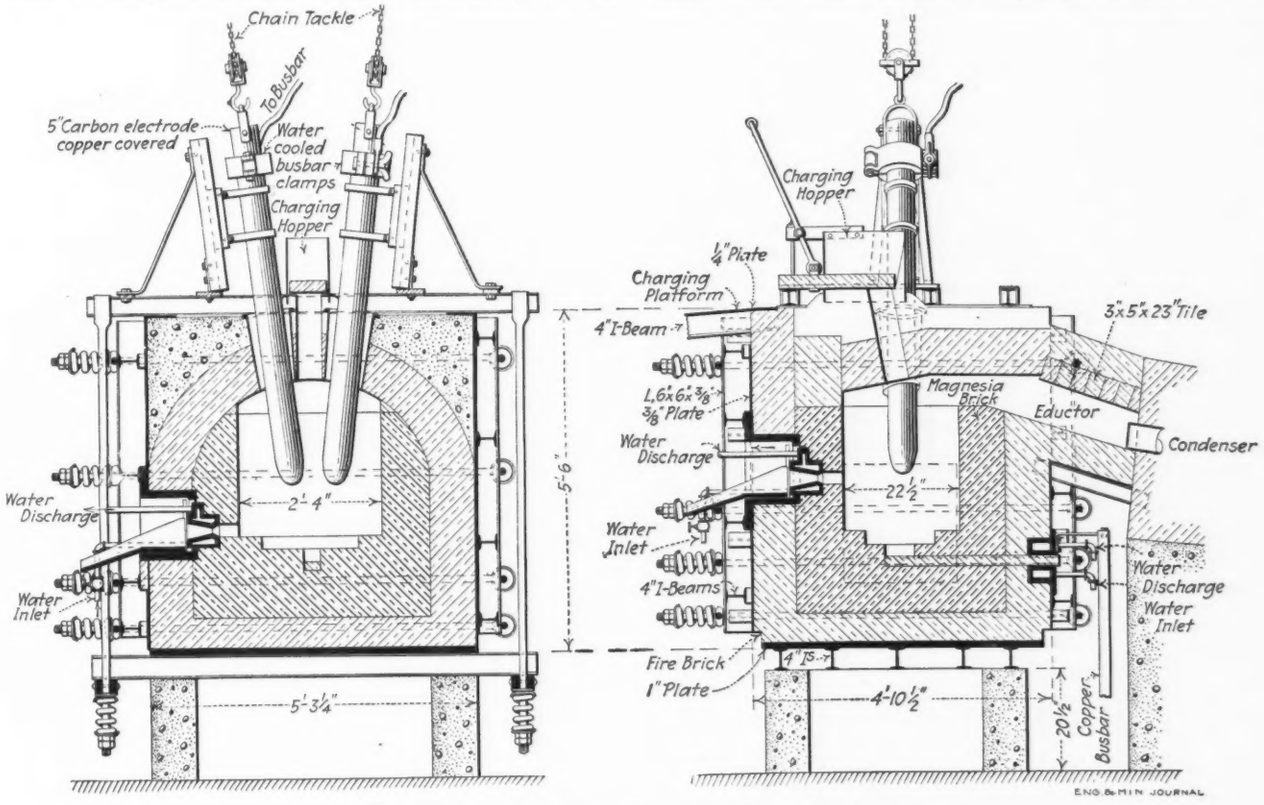
That Graphite Does Not Precipitate Gold from cyanide solution has been proved by Morris Green. "Trans. I. M. M.," 109, 1913. On the contrary, it accelerates dissolution.

Zinc Smelting in the Electric Furnace

By Woolsey McA. Johnson*

SYNOPSIS—A discussion of the differences between electric zinc smelting and the present fire-smelting process, and also between electric-furnace slags and slags made in the ordinary retorts. Emphasis is placed on commercial points of electric-furnace superiority. Attention is given to both the scientific and the practical aspect of the subject.

The Johnson electric zinc furnace produces in one operation spelter, a fusible slag, copper matte and base-lead-bullion, whereas the retort plant produces spelter and an infusible residue or clinker. For success the Johnson furnace must produce a slag of maximum fluidity, but the retort furnace must produce a residue of maximum infusibility. Electric-furnace methods, when the use of electric current is properly understood, allow of any temperature or of any possible desired chemical condition.



Johnson Continuous Electric Zinc Furnace

In the retort process any slag-making material is a bugbear. When I was metallurgist of the Lanyon Zinc Co., I used to divide the ores into two mixes, one "acid" and one "basic." I had the coals used for reducing materials analyzed so as to see that no coal with a fusible ash came into the works, as I did not care to have my retorts "gummed up."

At the Hartford demonstrating plant of the Continuous Zinc Furnace Co. we have turned from the retort plant and are moving in a metallurgical direction as far away as is the West from the East. The Continuous Zinc Furnace Co. mixes so as to make a slag as liquid as water. Instead of decrying lime in the ore, it desires lime in the zinc ores. Instead of penalizing iron in the ore, it needs iron in the ore. Instead of refusing to purchase ore with fluorspar in it, it wants fluorspar in zinc ore, for often it purchases gravel fluorspar to add to its zinc mix. Slag is not a bugbear, but a welcome friend to our process.

Electric Smelting Allows Wide Slag Variation

In the electric steel furnace, the slag plays a different commercial role. This is a refining process. The Johnson process is a smelting process. The Heroult furnace is intermittent. The Johnson furnace is continuous. In the Heroult furnace, aided by three powerful 500-kw. arcs, they smelt a slag containing from 60% to 70% lime. This is so high in lime as to wash the steel practically free from sulphur and phosphorous. This high lime slag would not be possible to melt commercially save in an electric furnace. In the work in California, Norway and Sweden in iron-ore smelting, we see that the metallurgist can use a wide range of slags at his will, some high in lime, some high in magnesia, some high in silica.

If one will examine electric-furnace methods such as used by the General Electric Co., or at Niagara Falls, one will be amazed at the potentialities. One will see definitely that any slag desired can be made; that it is not a question of chemistry but of business. We can make any slag we wish. What slag will make us the most

*Continuous Zinc Furnace Co., Hartford, Conn.

money? This is all especially true of making ferrovanadium, ferrochrome, ferromanganese and ferrosilicon in the electric furnace.

Limits of Zinc Slags

In the Hartford electric zinc furnace there has been made a variety of slags. These slags are all tested in the Johnson slag tester for fluidity.[1]. The adjustment of electrodes as to slope, height, voltage, amperage, and the feeding of the charge all are a matter of careful science and practical metallurgy. I know that it is possible to reduce the percentage of zinc in the slag and to hold it there, or to raise it up again.

We have made and tested practically, say on one ton or more, or less, about one hundred different slags. These have had a wide range of analyses. Our laboratory and furnace records show a maximum and minimum.

	Maximum	Minimum
SiO_2	58.0%	18.2%
CaO	36.5%	3.5%
MgO	13.5	1.0
FeO	33.3	3.3
Zn	24.0	0.9
Al_2O_3	19.1	5.9

We even made one slag containing 6% chlorine.

We can "knock out" the last percentages or traces of zinc if we please. The point is, "Will it pay to do it?" It is impossible to knock out the last traces of zinc in a retort furnace for the retorts would be butchered if this were attempted. In a retort plant, it is impossible to squeeze out the last part of the zinc so as to give a high recovery without spoiling the furnace.

In the Hartford furnace, affairs are quite different, for with the help from some of the best known metallurgists in the world, we have a lining and a furnace that, in my opinion, will stand any slag at a temperature of 3300° F., under the conditions peculiar to our operation. We operate our furnace at a temperature range of from 2300 to 2500° F.

The Continuous Zinc Furnace Co. is now building its latest electric zinc furnace for making in one operation spelter, slag, copper, matte, and lead-base bullion, the last two mentioned carrying the gold and silver contained, of a minimum capacity of three tons of roasted ore per 24 hours and a maximum capacity of five tons of roasted ore per 24 hours. It plans to build later a furnace of much larger capacity, say of 25 tons of roasted ore per 24 hours.

Suppose we treat in this a low-grade ore containing 28% zinc and make 40% slag. It is estimated that it will cost 70c. to tap the furnace with a modern water-cooled bronze slag monkey and that we will tap slag twice every 24 hours. This cost with amount of other charges will be about as follows:

COST OF GETTING SLAG FROM FURNACE TO DUMP PER TON ROASTED ORE

5-ton furnace, 2 tons slag	$0.40
10-ton furnace, 4 tons slag	0.30
25-ton furnace, 10 tons slag	0.25
50-ton furnace, 20 tons slag	0.22

In a retort furnace handling eight tons of roasted ore, the cost of removing residues is about as follows, a blowout man, a bumper and a chiseler being needed. (As laborers all work together, it is hard to make an accurate distribution of costs, but the following is substantially accurate.)

[1]"Electrochem. and Met. Ind.," Vol. IV, p. 262.

RENEWAL OF RETORT RESIDUES, RETORTS TO DUMP

Three-men days @ $2.00	$6.00
Cleaning residues out of cellars	2.25
Total cost	$8.25
Cost per ton of roasted ore	1.03

A careful estimate of losses contained in the residues of a retort plant per ton of roasted ore gives 60 lb. zinc. This is based on residues analyzing 5% zinc and on residues amounting to 60% of weight of roasted ore, which, with spelter at 5c. per lb. equals $3.

Commercial slags in the Johnson process have a probable maximum zinc percentage of 3%, and probable minimum value of 1% Zn with a probable average of 2% Zn. Making slag weighing 40% of weight of roasted ore we have a zinc loss in slag per ton of roasted ore of 16 lb., or a money loss of 80c., with spelter at 5 cents.

Electric Smelting Greatly Reduces Reduction Fuel

Another advantage in the continuous zinc process is the decreased amount of coal used. In the continuous zinc furnace making spelter, slag, copper matte and lead base-bullion in one operation, only enough carbon is added to reduce properly the oxides desired to be reduced. In the retorting operation making spelter and residues a large excess is usually added. A retort plant uses 60% coal, coke, anthracite or soft coal. Enough has to be added to furnish sufficient carbon to make the charge active and at the end of the intermittent operation to hold up the fusible impurities so that "pots will blow out clean." The Hartford demonstrating plant uses 15% soft coal. Assuming the cost of coal to be the same in each process, $3 per short ton:

60% coal at $3 is $1.80
15% coal at $3 is 0.45

In a slagging operation the production of copper matte and base lead bullion is at once unavoidable and desirable. This gives the plant having a continuous electric zinc furnace two important byproducts directly salable to a lead-ore smelting plant or to a copper-ore smelting plant.

J. E. Johnson, Jr., consulting engineer and metallurgist, visited our plant during a run. In a report, among other things, he said: "The feature which impressed me most in connection with this plant was the absolute control under which it ran and the extreme steadiness of operation and freedom from interruption of all kinds.

"My understanding is that the presence of zinc in lead or copper ores is a serious detriment to their successful smelting, and that the presence of zinc is penalized by the buyers of such ores; also, that the presence of lead, copper, iron and lime are highly objectionable in zinc ores for use in a standard retort process.

"The working of the furnace when I was there convinced me that there was no technical difficulty in producing spelter and, simultaneously, slag, matte and metallic lead, which could be tapped from the hearth of the furnace as desired. This matter, like all other industrial matters, is purely a commercial one, and it would seem to me not difficult to demonstrate by tests that ores now useless or of low value on account of their complex nature can be so handled in your continuous electric furnace as to recover a large part of the value of all ingredients, thus giving you virtually the sum of their metallic values rather than the difference of the same, as is customary with present smelting methods."

This gives the point of difference exactly. In a properly developed electric zinc furnace, it is metallurgical addition, not subtraction.

Another point in the favor of slagging against the dry-residue proposition of the retort is that it takes less heat because of the fact that the final temperature is less and because the quantity of material to be heated is much less.

A rather remarkable feature is the phenomenonally low percentage of copper, silver, lead and gold in the Hartford slags. Analyses have been checked by chemists of three large metallurgical companies, the General Electric Co. and the Massachusetts Institute of Technology.

Slag analyzing as low as 0.01% copper, 0.005% lead, 0.05 oz. silver per short ton are not uncommon. In fact, they have been so low that a report copper "trace," lead, "none," has been made several times.

From June 1 to 30, 1913, 16.9 short tons of slag were made. An average (not, however, a weighted average) sample analyzed by us, gave Cu, 0.065%, electrolytic assay on 5-gram sample; Pb, 0.05%, wet assay on 5-gram sample; Zn, 5.25%; Ag, 0.50 oz. per short ton on 2 a.t. sample; Au, 0.01 oz. per short ton on 4 a.t. sample.

This includes several taps in which poor settling occurred.

It can, therefore, be concluded that the Johnson electric zinc-furnace losses in values of copper, lead, gold and silver passing off into slag will be less than in lead-smelting plants and much less than the 15% to 25% in the combined treatment or thereabouts in a retort plant.

It is, therefore, believed that in the respect of making a slag instead of a residue the zinc furnace has many points of advantage. Those that are directly seen are as follows:

Removing residue	$1.03	
Removing slag	0.30	
Saving	$0.73	$0.73
Zinc loss in retort plant	$3.00	
Zinc loss in electric plant	0.80	
	$2.20	2.20
Coal in retort plant	$1 80	
Electric smelting	0.45	
	$1.35	1.35
Total net differential advantage in slagging over retorting per ton of roasted ore		$4.28

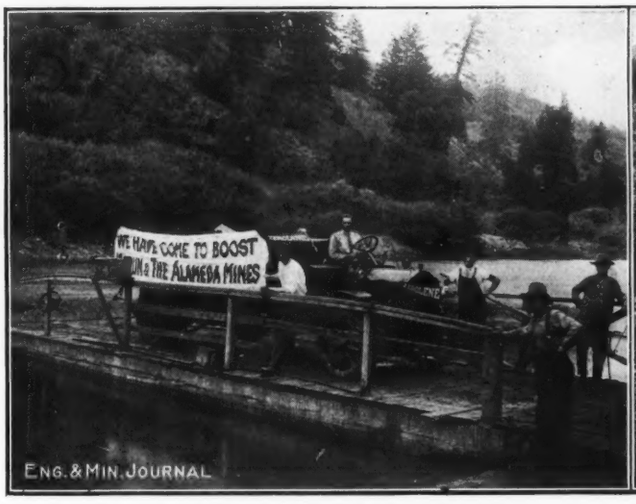
The increased saving of byproduct values such as gold, silver, copper and lead is greater than the above, but the indicated saving of $4.38 through specific advantages of electric zinc smelting is attractively large.

Reopening the Almeda Mine, Oregon

SPECIAL CORRESPONDENCE

The Almeda mine is situated in the Siskiyou Mountains, Josephine County, Oregon. It is quite near the Rogue River, one of the famous streams of Oregon, and has been for some years deserted as it had seemed impossible to operate it with any profit.

The mine has lately been examined by John Ross, Jr., who reported favorably as regards quantity and quality of ore, and believed that if transportation problems could be solved the mine could be worked at a profit. It is 17 miles from Merlin, the nearest railroad station, over a country which has extremely poor roads, when they can be dignified by even that name. Freighting charges amounted to $10 per ton from mine to railroad, and the inefficiency of such transportation would not permit of a large enough mine output to operate at a profit.



MOTOR TRUCK CROSSING ROGUE RIVER

STUCK IN THE ROCKS AT WINDY GAP

A truck manufacturer was consulted, and a transportation expert made a report which was so satisfactory that one 5-ton truck was sent to Merlin by rail, whence it was to haul coke and supplies to Almeda, and return with matte from Almeda to Merlin. The difficulties of the truck in going over this practically untraveled road were numerous. One bridge flattened out with it altogether, but the truck succeeded in climbing out on the other side without any serious trouble.

In crossing the Rogue River, the bridge for transportation not having been completed, the truck was compelled to cross on an old ferry boat, which it succeeded in doing without mishap. The most difficult point to pass was Windy Gap, where the roads passed through a rock cut which was very narrow, in fact, just too narrow to allow the truck to go through. As the path is on top of an eminence, a running start was taken to help the machine through, but it stuck in the rocks, and some work had to be done on the side to allow its passage.

It is claimed that the problem of profit and loss has been solved by the use of motor trucks between Merlin and Almeda, and that a large force of them will be put to work. Meanwhile work is going on full force at the mine, where the smelting plant is already installed.

New Mine & Metallurgical Construction

Magma Copper Co., Superior, Ariz., will build a 150-ton concentrator.

International Smelting & Refining Co., 42 Broadway, New York, is breaking ground for a smelting plant in the Globe-Miami district, Arizona.

North Fork Mine, Forest City, Calif., will build a 20-stamp mill early in the spring.

Golden Center of Grass Valley Mining Co., Grass Valley, Calif., is building a 10-stamp mill.

Midas Mine, Harrison Gulch, Calif., is building a 100-ton cyanide plant to treat current and accumulated tailings.

Field Smelting Plant, Redding, Calif., has installed a three-table roasting furnace, for experimental and demonstration purposes of the Field method of treating fume.

London Mine, Central City, Colo., has completed a mill at Twelve Mile.

Abel Guion, Empire, Colo., is building an amalgamation and concentration mill of 35 to 40 tons capacity.

Otto Mears and A. R. Wilfley, Silverton, Colo., are building a 500-ton mill to treat the tailings dump of the old Silver Lake mill.

Lakeland Phosphate Co., Lakeland, Fla., is installing a phosphate mining plant of 100,000 tons annual capacity.

H. E. M. Mine, Wallace, Idaho, will be equipped with a 100-ton mill, which will be the first of several units to be built later.

Lawton Mining Co., Lawton, Kan., is building a concentrator.

John Hall Co., Lawton, Kan., has nearly completed a concentrator.

Larkin Mining Co., Lawton, Kan., has a concentrator nearly completed.

Oakes & Church, Lawton, Kan., are making preparations for building a concentrator.

Portland Lead & Zinc Co., Joplin, Mo., has recently completed a 400-ton concentrator.

Athletic Mining Co., Webb City, Mo., will rebuild the mill destroyed by fire Sept. 1.

A. B. C. Mining Co., Joplin, Mo., will remove the 200-ton mill, known as the John Jackson mill, to the south shaft on the lease of the A. B. C. Mining Co., which had been completed when a fire destroyed the mill about 500 ft. south of the old millsite.

Timber Butte Milling Co., Butte, Mont., is building a 500-ton zinc concentrator.

King & Queen Mining Co., Keystone, via Superior, Mont., is operating an experimental mill of 75 tons daily capacity; will build a larger mill as soon as water supply arrangements, now underway, are completed.

Anaconda Copper Mining Co., Butte, Mont., is reconstructing the Washoe mill, and will add thereto a slime concentrator, of 2500 tons capacity, at a cost of $650,000; the plant comprises 20 of the 20-deck round tables. The smelting works at Great Falls is being rebuilt.

Howard Mines Co., Goodsprings, Nev., has just completed a 50-ton concentrator.

Hill City Mining & Development Co., Hill City, S. D., will build a gold mill.

Otho Mine, Keystone, S. D., is building a 150-ton concentrator.

Rattlesnake Jack Co., Galena, S. D., is building a 50-ton cyanide plant.

Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, will build a 500-ton concentrator and is reconstructing its furnaces for pyrite smelting.

Sir George Paish's Views

Sir George Paish, editor of the *Statist,* in an interview with the New York *Sun* on Nov. 11 predicted a reduction in the cost of living, his reasons being as follows:

The people of the East and West have not had the same degree of good fortune. The big rise in prices a few years ago was a cause of grat good fortune to the farmers, but was not equally beneficial on the whole to other clases of wage earners. The great increase in the cost of living was due to the great rise in the cost of food stuffs, raw textiles and other natural products; so that the prosperity of the farmer meant the detriment of wage earners in industrial lines.

These classes of wage earners are now due for a share of good fortune. A measurable reduction in the cost of living is due. The rise in the cost of living came from the remarkably good credit the world enjoyed in the past ten years and the greatly increased consumption of nations that were able to borrow more than they had ever been able to borrow before. In fact, the world's demand got to a point where it greatly exceeded the supply. That situation has now been modified.

Many countries are experiencing great difficulty in satisfying their need for capital and very little new work is being undertaken anywhere in the world. This means that for a time, at any rate, the demand for goods and the consumption of many countries will be reduced, and there is a probability that the supply of goods will be in excess of the demand. The price of commodities will fall therefore.

How soon this condition of things will become apparent cannot be predicted with certainty, as new demands for capital which must be satisfied may arise. For example, if the Mexican situation were to develop and trouble were to arise between the United States and Mexico large orders would have to be placed, for clothing, munitions of war and other things needed by a great army and a fresh stimulus would be given in this country to trade and consumption.

But, failing such conditions, the restoration of peace in Europe and the economies of young countries which have borrowed so heavily in recent years cannot fail to bring reduced consumption. And reduced consumption will bring in its train lower prices of commodities and reduced cost of living.

As far as this country is concerned such conditions would not be to the disadvantage of the East as much as to the West, as the latter has derived greater benefit in proportion than the former from the rise of prices in the last ten to fifteen years.

Of course the East would in some degree suffer from a reduced demand for manufactured goods, but on the other hand the incomes from interest, services and even from the manufacture of goods would give the East a greater relative consuming power. It is, however, highly improbable that prices will fall to anything like the level they reached in the '90s.

As far as can be seen the reaction in the world's trade will be a moderate one, and the great accumulation of gold which will probably result will soon tend to restore confidence and make for expansion in trade and consumption after a relatively short period of rest and recuperation.

Output of Radio-Active Ores in Colorado is on the increase this year, and it is estimated that a gain of 30% will be made over the output of 1912. In transporting carnotite ore from Paradox Valley mines to Placerville, the shipping point in the San Miguel district, 50 six-horse teams are engaged and returns have been received of $6658 for one carload shipped from the Long Park mine by W. R. Turner. This mine has been purchased by the Colorado Carnotite Co. In Gilpin County, in the Calhoun mine, in Leavenworth gulch, there are large bodies of pitchblende occurring with gold-bearing smelting ores. The shoots are said to be 40 ft. in length, with an average width of 3 ft. and ranging in value from $100 per ton to $600. The German, Wood and Bechter mines in the same district are also producing pitchblende ore, and, as already stated in the "Journal," these last have been purchased by Alfred Dupont, of Wilmington, Del., for philanthropic purposes.

The Assessment of Mines

SYNOPSIS—A discussion of the relative merits of valuing a mine for taxation on ore in sight and assumed reserves, or on its annual output. The suggestion that it be on Stock Exchange value is believed to be entirely inequitable.

The question arises, how shall we determine the true cash value of various mines so that the values arrived at will be equitable not only to the state, but as between the mines themselves, as we may without doubt dismiss from our minds the solution of the problem that the true cash value can be determined by oracularly standing at the mouth of the shaft and looking down it, as one can stand in the center of a farm and look around its fields, or can stand at the intersection of two streets and see the building on the corner lot.

The result in Arizona is that there are two schools; the first demanding the physical valuation of mines by a careful study of them by a competent engineer or board of engineers. In the case of the porphyry mines this would be relatively simple. One would know the life of the mine to be 15, 20 or 25 years, one could assume an average selling price for copper, the costs are well known, and it could be easily calculated that the mine could produce so much net profit for, say 20 years. Then by the use of actuary tables the present values of all of the annual dividends could be calculated and the sum of them would be the present value of the mine. This has been worked out quite carefully by H. C. Hoover in his classical work, "The Principles of Mining."

If the same engineer should examine one of the vertical mines which was yielding the same annual profit, and could find but two or three years of ore in sight, he would be forced to one of two conclusions; either to fix the present value of this mine, based upon the two or three years' ore in sight, or else to make a guess far into the future, and say that this or that mine in his estimation would last five, 10, 15 or 20 years. This it is impossible to do, and the owner of a mine, if he chose to be technical, could without doubt upset such an assumption as being arbitrary in the extreme.

The other school claims that the value of a mine should be based by taking as the primary facts its annual production, and the profits arising from that production, and that the value of any property in its ultimate analysis really is based upon the profit that it can make. It, therefore, demands that the mines shall be assessed using these figures as a basis. If a mine lasts for five years, then it pays taxes for five years, if it lasts 20 years, then it pays taxes for 20 years, and the state loses nothing by the transaction.

The claim is made that inasmuch as taxes are paid annually the question of valuing a mine for the purpose of taxation is radically different from that of valuing it for the purpose of sale or purchase, or consolidation with other mining properties. It is, of course, assumed that if two mines are to be consolidated, each making the same annual net profit, one of which it is fair to assume has a five-year life, and the other a 10-year life, that the second mine should be given greater value in the consolidation, but for the purpose of taxation the factor of probable life may be omitted because the taxes are not paid in a lump sum in the beginning as would be the purchase price, but are paid year after year.

Note—Excerpts from a paper by P. J. Miller, member of the Arizona State Tax Commission, read at the conference of the National Tax Association, at Buffalo, N. Y., Oct. 25, 1913.

Objections to Valuing on Ore in Sight

If the value of the mine were to be based upon the tonnage of ore in sight it would be an incentive to the mine owner to retard his development, which eventually would be a detriment to the state, as unquestionably development ahead in a mine tends to prolong its life, as it carries a man over those periods of poor showings in a mine when he might be tempted to abandon it.

The present mine-valuation law in Arizona, which was passed in the early part of 1913, provides that mines shall be assessed by adding together one-eighth of the gross production for the previous year, four times the net profit for the previous year, and the value of the improvements. This then represents "the full cash value of the mine," and in most cases amounts to about five times the net annual profit. In other words, the mines are put on approximately a 20% basis, of which it may be considered that 10% is income (which is not considered high in Arizona considering interest rates and the risks in mining), and the other 10% is to return the capital invested, because it must be borne in mind that a mine is in a constant state of liquidation from the day that it starts and that when the ore is exhausted the surface plant and reduction works, no matter how much they may have cost, are of no value. Hoover, in his "Principles of Mining," in determining the present value of a mine does not consider the plant or reduction works as one of the factors to be added in. In Arizona this point was seriously discussed, and while a number of the advocates of the second school strenuously held out for a nonassessment of plant, the legislature considered this too radical a change and therefore declined to omit it. Many of the advocates of the latter system would have preferred to have used a greater factor in multiplying the net profit and not have had the plant considered in the assessment. This is a point which should be given careful attention, as it seems unfortunate to penalize the low-grade mine, which of necessity must have a more expensive plant per pound of annual production. Under the present law, the porphyry mines with all of their ore developed are put on practically the same basis as the vertical-vein mines, in which the life is unknown but is surmised to be in many cases as great as that of the porphyry mines. This, therefore, results in the state very likely getting more revenue than it would had the physical method of valuation been decided upon.

The Finlay System

The advocates of the physical method of valuation lay great stress upon the method developed in Michigan, upon what is known as the "Finlay system." In this case the state tax commission employed J. R. Finlay, of New York, one of the most distinguished mining engineers in America, if not in the English-speaking world, to examine all of the copper and iron mines in Michigan and report to the commission his opinion as to their

value. The time given Mr. Finlay to make this examination and report was short, but he quickly organized a staff of assistants and the results, as a whole, were satisfactory to the commission, though later on cases of inequality developed which the tax commission and the local assessors have been attempting to straighten out.

It should here be borne in mind that the valuation of the mines as determined by Mr. Finlay were by no means the valuations which were placed upon the assessment books of the various counties. The tax commission, for example, might from its study of assessments conclude that one of the counties in the upper peninsula should be assessed at $50,000,000. From the information which it had it might have assumed that the mines were worth $40,000,000 and the other property in the county $10,000,000. It thereupon certified to the county board of supervisors that the county assessment must total $50,000,000. It was then left entirely to the board of supervisors as to how that money should be divided, and if they in their judgment thought that $25,000,000 was enough for the mines, then the balance of the property in the county had to come in for the other $25,000,000. I am informed and believe that practically this state of affairs exists in Houghton County today, this being the county in which the famous Calumet & Hecla mines lie.

In determining the value of the copper mines in Michigan Mr. Finlay had a comparatively simple problem, as all of these mines are comparatively narrow beds, averaging, say 14 ft. wide, and dipping at a regular angle to the northwest. Some of these mines were only 1000 ft. deep, but one of them was at least 8000 ft., measured on the slope, another one was 5000 ft., and several were 3000 ft. The lodes as a whole are pretty uniform, so that after a mine had been worked down 1000 ft. and the relative proportion of pay and poor ground determined, it was easy to assume a life of the mine, estimating that the ultimate depth of the mine would be in the neighborhood of 7000 ft. Taking then an average price of copper, and taking the costs of producing this copper, and figuring in the life of the mine, Mr. Finlay arrived at a certain valuation for the various copper mines of the upper peninsula. He did not have the problem, as in Arizona, of two radically different types of mines, but had a problem which might be considered a compromise between the two, that is, the steeply dipping vein whose future life could be fairly well predicted.

When, however, Mr. Finlay took up the iron mines of the state, he was up against an entirely different problem, for here the ore occurs in most irregularly shaped masses, development in many cases was not carried far ahead, and in my opinion the valuation put by him on the iron mines was too low and against the interests of the state simply for the reason that Mr. Finlay was unable to, and from the nature of things could not, determine the ultimate life of the iron mines, assuming that he was fairly correct in determining the value of the copper mines. Had the value of both the iron and the copper mines in Michigan been based upon the annual profit, I believe that the revenue of the state would have been greater and that a large amount of dissatisfaction would have been avoided.

Workings of the Michigan Law

The present arrangement in Michigan is almost ludicrous in its results. A ledger is to be kept and an account is to be opened with each mine. It is to be charged up with the new ore developed during the year, and it is to be credited with the ore shipped. An immense amount of office work is to be carried on, a corps of mining engineers is to be employed, and when they get all through they are no better off than if they assessed the mine each year on the basis of what it had produced for the year before.

This is supposed to be an era of conservation, and yet if you will proceed to assess and to tax mineral resources, which in the ordinary demand of the country should not be taken out for 20 years to come, are you not putting a premium on the early exploitation of its natural resources, and are you not inducing the owner to get it out and sacrifice it, rather than to hold it in reserve for a later generation? It is, of course, admitted that we must not deprive ourselves of necessities, or even a moderate amount of luxuries, for the unborn generation, but certainly we do not wish to repeat in our mineral industry what we have done in the past in our timber industry. Along this line of argument it is to be noted that Pennsylvania has made an arrangement by which cut-over lands which are reforested are taxed but a nominal amount until such time as the timber is developed and is ready to be cut and sold.

Whether the percentages adopted in Arizona are sufficiently high, it is not for me to say; in fact, the legislature has made the present law only operative for two years, so that we may have an opportunity of seeing how it works out, and what relation the total assessed value of the mineral industry of the state bears to the agricultural, cattle and other industries.

There is another school which thinks that the value of the various mining stocks, as quoted on the various exchanges of the country, should be the measure of the value of the mine for the purpose of assessment, but it appears evident that these daily quotations of a few hundred or a few thousand shares can be either unduly advanced or depressed by purely local circumstances and by conditions of ownership, and do not reflect the real value of the property. In several cases the names backing a mining company have such a good reputation that stocks which they control are quoted higher, or, in other words, pay lower rates of interest than those of other people. This simply indicates that the investor banks upon their honesty. Therefore, the quotation of a stock covers two things, the value of the mine, and the good name or will of the management.

Some of the Outside Factors Influencing Mine Value

It is interesting to note that within a few years the question of the valuation of the Franklin Furnace mine in New Jersey was up before the courts. This mine is peculiar, the ore being a complex mixture of iron, manganese and zinc. It was examined by a number of prominent engineers, and if my memory serves me correctly, the value placed upon the property varied all the way from $4,000,000 to $20,000,000. In this case the value of the mine was complicated by the question of the Wetherill magnetic-separation process. Without this process it was claimed that the ore could not be profitably treated, and, therefore, part of the value of the property, together with its magnetic mill, was eventually given to the Wetherill patents.

In the case of the sulphur mines of the Union Sulphur Co., of Louisiana, in which the ore is mined by blowing down superheated steam and compressed air through pipes, it was eventually decided by the court that one-half of the value of the property was in the deposit of sulphur and the other half in the Frasch patent covering this method of extracting it.

These two cases are quoted to show that the stock value of a mining property by no means covers only physical value of the property and its improvements.

For my own part, as a member of the tax commission, I must say that I prefer the method adopted by Arizona. Whether the net profits should be multiplied by four, or five, or even 10, I am not yet prepared to say, but I firmly believe that the method which we have tentatively adopted is the one which in the long run will redound to the best interest of the state.

Current Events on the Iron Ranges

MARQUETTE CORRESPONDENCE

Curtailments in working forces have been made lately on the Marquette, Menominee and Gogebic ranges, in Michigan. A few mines have been closed. While there is no doubt that the iron-mining men of the Lake Superior region are working cautiously, while they are ascertaining the course of events in the business world following the enaction of the new tariff, curtailments at this time of year are seasonable. It is a usual thing when the rush of the water shipments draws to a close to reduce forces somewhat against the coming of winter. The producing properties are, as a rule, being operated on a normal basis, and the outlook is not at this time serious.

It is not believed at present that 1914 will be a runaway season in the ore business, for there are various disquieting factors that will have a tendency to hold it back. It will be rather surprising if prices hold up to the figures for the present season, and just now it is the expectation that contracts will not be closed until considerably later than usual. Any appreciable reduction in ore prices would, it is believed, have a corresponding effect on lake freights.

EFFECTS OF FREE PIG-IRON TARIFF

One of the elements in the situation which is causing the iron men concern is the provision in the new tariff law placing pig iron on the free list. If it should develop that this is to mean a notable increase in the importations of pig, the mines of the Lake Superior region would be ultimately affected, the degree depending on the extent to which the demand for domestic ores was decreased by the iron produced abroad.

Operations have been permanently suspended at the Milwaukee-Davis mine, at Negaunee, and there has been a practical suspension at the Washington mine, at Humboldt, where a force of 130 men employed for several months has been reduced to about 30, who will be engaged on exploratory work. Both of these properties are on the Marquette range and are members of the group controlled by Edward N. Breitung. Just when operations will be resumed with the usual force at the Washington, it is now impossible to say. The Milwaukee-Davis will, however, be abandoned for all time, as soon as the ore that can be readily removed is taken out, and the workings will be allowed to fill with water. The machinery will be removed. The Milwaukee-Davis has been mined in a small way and explored for the last two years or so. The company has arrived at the conclusion that it does not warrant further attention. In addition to the suspension of production at the Washington, the Breitung interests have reduced their forces at the Mary Charlotte and Breitung Hematite mines, at Negaunee, by about 100 men, but with these reductions the properties of the group are on a winter footing and there will, it is said, be no further curtailment of forces. Excellent progress has been made with cleaning out the stockpiles at the company's Negaunee mines and by the close of navigation the properties will be in good order for the winter's work.

The Cleveland-Cliffs Iron Co. is preparing to mine the ore contained in the area that formerly was the cemetery at Negaunee, Marquette range. The old highway extending from the city to the tract has been fenced off and the ground will be permitted to cave. It was necessary for the company to provide a new cemetery, as well as a road leading to it, and this work, together with the removal of the bodies and the tombstones, cost approximately $250,000. Rains in the Marquette country lately have relieved the Cleveland-Cliffs officials of the anxiety that it would be necessary to operate some of the mining plants with steam, the water in Carp River having been lower than at any time since the corporation's big hydroelectric plant on that stream went into commission. Unusually heavy precipitation filled the storage dams to a level that is believed to assure an ample supply of water during the fall and winter.

CLOSING OF THE GROVELAND MINE

In consequence of the litigation in which the stockholders of the Groveland Mining Co. have become involved, resulting in the appointment of a receiver, the Groveland mine has been closed. About 20 men are out of employment as a result. The property is in the Randville district of the Menominee range. Pickands, Mather & Co., of Cleveland, who have been operating the Vivian mine, at Quinnesec, Menominee range, ever since it was opened in 1902, have decided to abandon the property. The machinery has been dismantled and shipped to Iron River. During the present season the ore in stock on surface and that broken underground was shipped. The Vivian has been operated irregularly and its total production is about 500,000 tons. The largest season's shipment was 122,500 tons in 1906. The ore is low grade. The deposit is a large one, but Pickands, Mather & Co. have bodies elsewhere that can be mined at lower cost.

After shipping a small amount of ore, the Spring Valley company's Zimmerman mine, in the Iron River district of the Menominee, again suspended work and the property is once more all but deserted. While 200 men were affected when the Cleveland-Cliffs Iron Co. recently put its furnace at Gladstone, Mich., out of blast, none who desired work has been thrown out of employment. The company operates large camps at which wood for its chemical plants is cut, and all men willing to work as choppers have been sent to the forests. The Cambria Steel Co. has added to its Upper Michigan timber holdings 240 acres in the Witch Lake district of Dickinson County. The purchase price was $3500. The timber is for the Republic mine, Marquette range, but probably will not be cut for several years.

Anderson & Burrell, of Minneapolis, railroad contractors, are putting in four tracks at the Schlesinger com-

pany's Palms mine, at Bessemer, Gogebic range, for the Chicago & Northwestern as well as an approach to the coal dock at the Anvil mine shaft. It is expected the work will be completed by Dec. 1.

The matter of stripping the Balkan property of Pickands, Mather & Co., having been held in abeyance pending further drill work, bids on the contract for removing the overburden have again been asked. It is figured now that, instead of 1,800,000, only 1,200,000 cu.yd. of surface material will have to be removed to create the proposed open pit. The Balkan is in the Mastodon district of the Menominee range, its deposit forming part of the big orebody discovered by the Longyear-Pillsbury-Bennett interests. The drilling operations carried out by Pickands, Mather & Co. unexpectedly revealed the existence of a horse of rock, one so considerable, in fact, that on examination of the new records the state tax commission reduced by $400,000 the tentative valuation placed upon the property. At that part of the Mastodon tract retained by the Longyear interests, and which has been named the Judson, a big shaft is being sunk at an angle of 45°. The quicksand overburden has thus been avoided, as has an immense amount of water. In time there will be sunk a second shaft to mine the deeper ore. It is probable the Judson will be in a position to ship before the end of another season. The work is being pushed as rapidly as possible and men are being added as fast as room can be made for them. The mine is being superbly equipped.

Dissatisfaction with Tax Valuations

The U. S. Steel Corporation is shipping 25,000 tons of ore from its stockpile at the Michigan mine in the Amasa field, north of Crystal Falls, Menominee range. The great bulk of the pile, or approximately 125,000 tons, will be carried over until next year. The mine is not now in operation. With reference to the assessment of these stockpiles, an official of the Michigan state tax commission is authority for the statement that the commission recognizes there is much justice in the contention of the mining companies that the property has been overvalued and that it will take steps to establish an equitable rule for assessing in the future. It will apply a rule that will be fair alike to the companies and the general public. The commissioners themselves are not satisfied with the present valuations, but the questions involved in the stockpile problem were brought up so late it was impossible to change the whole basis of these valuations this year.

For the purpose of treating siderite ores, the Lake Superior corporation is installing a battery of five ovens at its Magpie mine, in northern Ontario. An oven of the same kind is already in service, having been employed in extensive experiments, the results of which are reported to have been highly gratifying. It is claimed that by the new process the siderite ore will be brought up to 54% iron, compared with but 36% in its raw state, and that because of its porous nature after treatment it will be most desirable for use in the furnace stack. Experiments have been in progress for several years, and now that $250,000 has been appropriated for building the plant, it is considered that the company is at last satisfied it has developed a process by which the low-grade ores of Algoma can be utilized profitably. The corporation has already 20,000,000 tons of siderite ores in sight, with the probability that the deposits are much greater. The output of the six ovens will be 840 tons daily.

Comstock Affairs

Special Correspondence

Until lately, both sides in the Comstock controversy have been resting on their guns. The Mexican company took out all the ore standing above the 2500 level, and then closed down the mine. That was last May. After that the mill was run on Mexican ore that had been accumulated on the dump, and on Monte Cristo ore. The latter comes from the Monte Cristo mine, owned by Charles Butters & Co., Ltd., about one mile east from the Mexican mill. The Mexican company constructed a tramway to it, and since finishing its own ore, has been milling about 100 tons a day from the Monte Cristo. This ore is of low grade, about $6 to $9 per ton.

Not long ago the Mexican company was asked to make a proposition setting forth the conditions upon which it would resume payments to the Pumping Association. The Mexican management replied that it would do so, provided a definite plan of unwatering the mines were adopted, together with a definite plan for ventilation and exploration, and the signing of a positive agreement by which the several companies would be legally bound to make their contributions. In the past, any company that did not feel like paying the association its share simply did not do so. At one time this resulted in the Mexican being the only company that did not owe money to the association. The Mexican management also insisted that the Pumping Association must be in neutral hands.

There is some prospect that something of this kind may be brought about. W. C. Ralston, of San Francisco, was recently elected president of the Pumping Association, and in order to promote plans for harmony, he has visited Virginia to talk over the situation with the respective superintendents, and is trying to formulate some pumping plan that all will agree to.

Nearly all of the companies of the Comstock Lode, except the Slosson companies, are heavily in debt, and some people think that the assessment game is about dead. If it were not for the talk of harmony and of new pumping plans, it probably would be hard for most of the companies to collect more than one more assessment. The Pumping Association itself, at last report, owed $84,000, mostly to the electric power company and to the Virginia & Gold Hill Water Co. Mr. Ralston, the new president, is a broad-gage man, unaffiliated with the old ring.

The water, thus far, has been held by the Association at the 2500 level, and it is preparing to lower it 200 ft. more by means of Starret pumps. The latter is a type of compressed-air displacement pump, in which air is also blown into the discharge column.

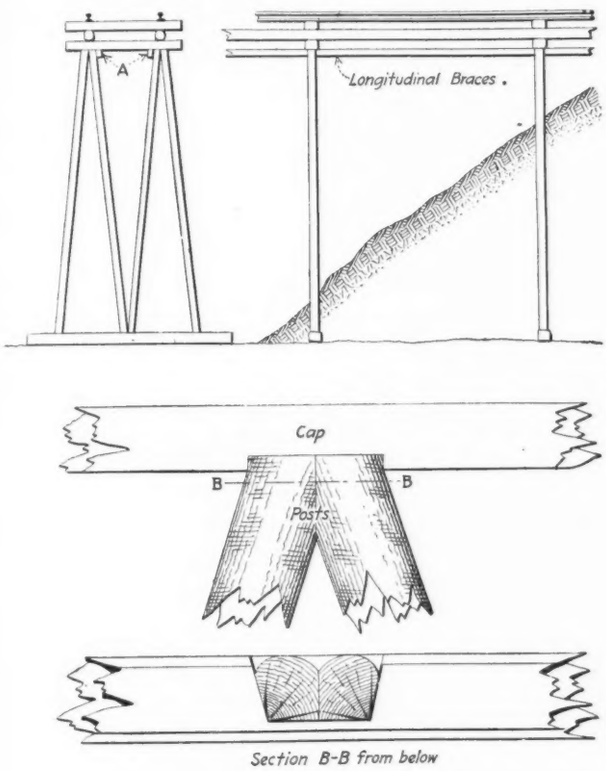
Cowles Electric Furnace Litigation

The U. S. Supreme Court on Nov. 10 denied the application of the Carborundum Company for a writ of *a certiorari* in the case of the Electric Smelting & Aluminum Co., which had previously been decided in favor of the latter by the Circuit Court of Appeals. This, we understand, terminates the litigation on the electric-furnace patents of Alfred H. and Eugene H. Cowles and legally establishes that they were the pioneers in electric smelting. Their patents expired several years ago but the Carborundum Company is now obliged to pay for their use up to the time of their expiration.

DETAILS OF PRACTICAL MINING

Post and Cap Joint for Dumping Trestle

The material stripped from the Mesabi open pits is disposed of in great dumps, which are built out and up from a single trestle extending the length of the projected sump. This trestle is of light construction, serving only to start operations and is finally buried and left. The method of construction is shown in Fig. 1. The first material stripped is dumped in and around the trestle so as to make it a fill. Dumping begins at the end of the



POST AND CAP JOINT FOR TRESTLE

trestle near the pit. The train approaches the dump with the engine behind; when the first car is at the end of the filled part of the trestle, it is dumped, pushed ahead on the trestle and the next car dumped. In this way the light trestle has to support empty cars only. There is always an inclined face or toe to the fill which exerts a considerable pressure on the posts of the bents which it surrounds, as seen in Fig. 1. The tendency is to push the posts out from under the caps. To prevent this, longitudinal braces are usually set between the posts under the stringers. At the Leonard mine in a recent trestle, these braces were omitted and the posts framed into the caps for an inch or two in a sort of box, the joint *A* of Fig. 1 being made as shown in Fig. 2. This evidently prevents the posts from being pushed through, and in practice has proved satisfactory. It saves the entire cost of the braces and also the labor of setting them, while the labor of framing in this manner is little more than for the former method.

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Substitution of Air for Water in Diamond Drilling

Diamond drilling in some kinds of unstable rock, as the copper-bearing schists of Miami, Ariz., is made difficult and expensive by caving of the sides of the hole, according to Ralph Wilcox, in a paper read at the Butte meeting of the A. I. M. E. As this caving is much increased by the use of water, it occurred to him to use air instead of water.

After some experiments it was found perfectly practicable to use air, forcing it down the hollow rotating rods as is done with water, the air passing around the bit, which is thus cooled, and ascending on the outside of the rods to the collar of the hole, carrying the borings as satisfactorily as had been done by water, but without the accompanying destruction or caving of the sides of the drill holes.

When water was encountered, it was forced up to the collar just as when water is used, but with the decreased flow there was relatively less washing or caving.

The only change necessary in the arrangement of the drill is that a cross instead of a tee is used at the collar of the hole. A tightly woven jute bag is attached to one arm of the cross, for collecting and filtering the sample; and when drilling in dry ground a jet of water is attached to the opposite arm of the cross, to collect the dust and wash down the sample into the bag. The rods rotate through a stuffing box attached to the upper opening of the cross. The distention of jute bag by the issuing air indicates the operating conditions as sufficiently as did the flow of water when using water in the drill hole.

The small percentage of core recovery rendered it necessary to rely almost entirely upon sludge samples. Great care was taken in recovering these samples, which were all weighed to detect the presence of caving. A winze has lately been completed which was sunk on one of the drill holes for the purpose of checking the sludge samples; the samples from the winze and the samples obtained in the drill hole checked accurately.

The experience at Miami in the use of air has extended over six months and has shown that the refrigerating action of the air in expanding around the bit is effective in cooling the bit and the diamond consumption has not increased; it has not been found necessary to decrease the speed of rotation of the bit. The difficulties of operating in the friable copper-bearing schist have been decreased fully 75% by the use of air, and the sample weights and the results of sampling checked perfectly. There is no indication as to whether one would be limited as to depth in dry holes; here the greatest required depth was about 300 feet.

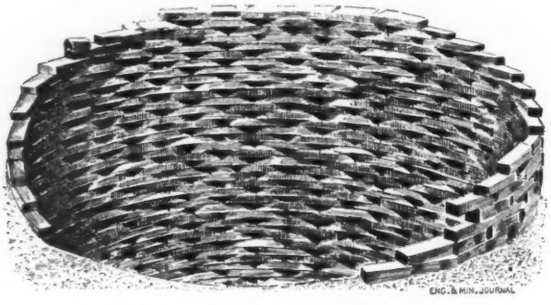
Tests as to amount of air used showed a maximum consumption of 83 cu.ft. of free air per minute, while the

least with which operating was practicable was 23 cu.ft. of free air per minute. The average used during the several tests was 47 cu.ft. of free air per minute, at 75 lb. pressure.

Apart from affording much relief in diamond drilling of friable rock, such as above referred to, there arises the possibility of drilling in regions where a scarcity of water would otherwise prevent operating. Drilling in these regions could be accomplished by the use of a portable compressor driven by a gasoline engine, which is another not inconsiderable advantage.

Block Lining for Round Shaft

In the Southern Appalachian kaolin mines, both open cut and shaft mining are practiced, according to the U. S. Bureau of Mines. The deposits are never deep, and when shafts are sunk, they are made of circular section, rather large and are lined with a block cribbing. The timber used is yellow pine or oak, cut in blocks 4x6x30 in. and beveled at the ends, so as to key together when set. Successive rings of these blocks are laid with the

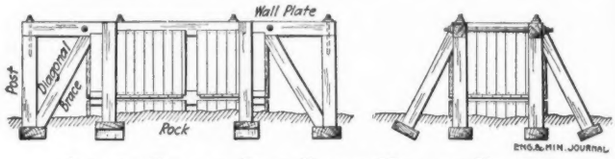


BLOCK LINING IN SHAFT

joints staggered, as illustrated. Operations are begun by excavating the shaft for 4 ft. and then placing the timbering from the bottom up. The ground is friable and will not stand long alone. Every fourth rung is spiked to the next lower to counteract any tendency to twist. When the timber is placed to the collar, the shaft is extended 4 ft., the material below the timbering being left in place. Timbering is then begun at the bottom of the new lift, the ring of material under the old timber having been removed and the old timber supported by props. In completing a ring, the material back of the last block is removed sufficiently to permit the insertion of this block from behind. The opening is then packed to give a tight bearing to the block. When the old timbering is reached, this method is impossible and in such case the last block is cut 4 in. short and a piece of 4x4-in. timber driven in and spiked tight. In the illustration, the uneven nature of the ground accounts for the difference in height of the cribbing. Hoisting is performed with a derrick and bucket.

Collar Sets at Butte

In erecting a collar set at Butte, Mont., its height above the ground is determined by the amount of room available for dumping waste rock from the sinking operations. In a level place this height might be up to 20 ft. (A. I. M. E. Bulletin, August, 1913.) In the accompanying illustration is shown a typical collar set for a two-compartment shaft; this, however, being much less than 20 ft. in height. The wall plates are usually made 10 ft. longer than the shaft sets, thus projecting 5 ft. at each end. Posts resting on blocks are stood under each

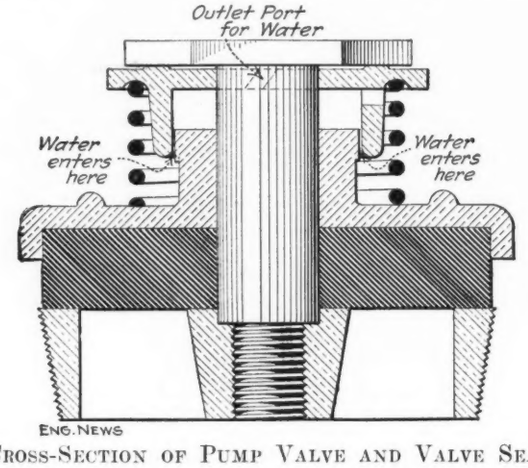


SHAFT COLLAR SETS BUILT UP AND BRACED

end and diagonal braces are then placed around the shaft to carry part of the weight and prevent the sets from moving. The set bears the weight of the shaft sets below and usually that of the headframe also.

A Rotating Pump Valve

A new valve seat for pumping-engine valves has recently been developed, which is claimed to effect a saving in life, slippage and friction of the rubber valve, states *Engineering News*. With the common, straight-port seat, the water passes through the port vertically, striking the valve at right angles, producing considerable



CROSS-SECTION OF PUMP VALVE AND VALVE SEAT

friction. As the valve closes on the same spot at each stroke of the pump the pressure soon indents the rubber with the ports of the seat, and results in leaks.

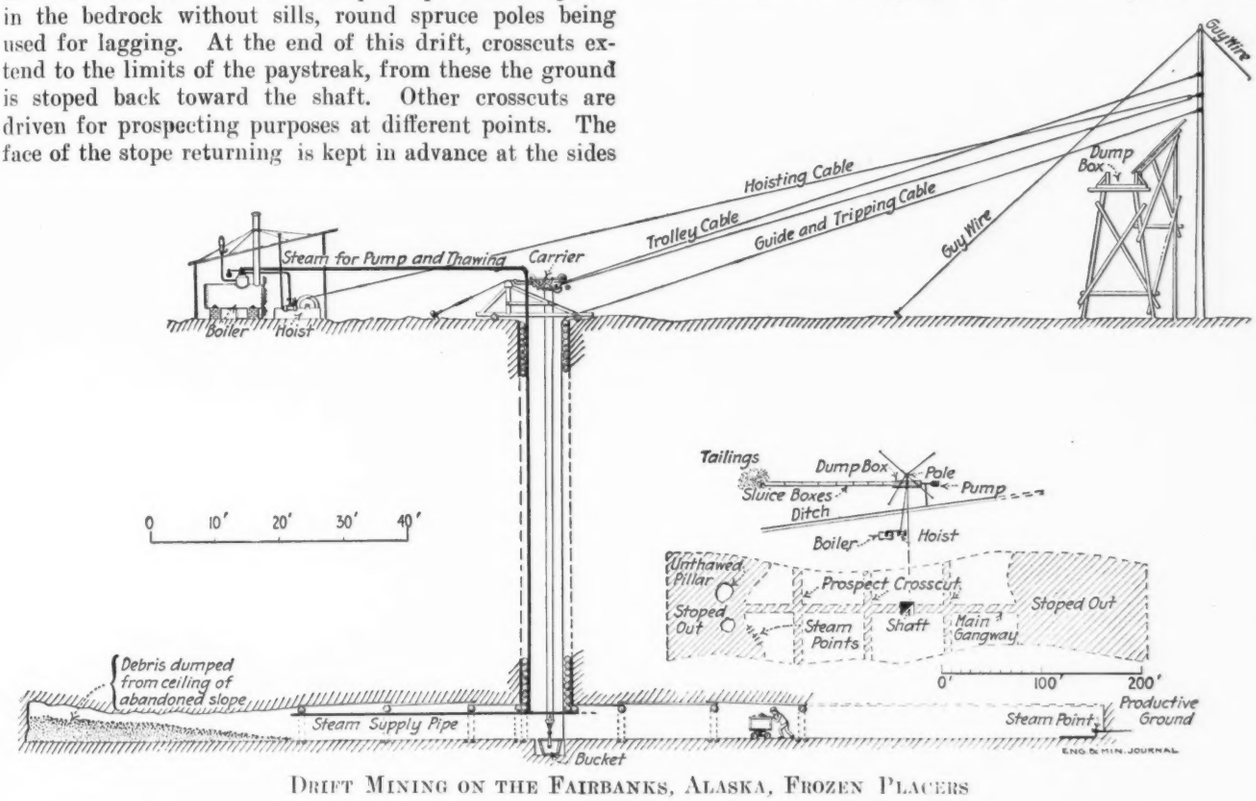
The new valve with its seat consists of six parts, as shown in the accompanying cross-section. The lowest element in the drawing is the seat with ports so formed as to give the water a spiral twist in passing through. The rubber valve rests upon this seat; above the valve is a guard plate of the same material as the seat, and fitted with a plunger which works within a spring collar. The latter is just below the hexagonal portion of the stem, and separated from the guard-plate by a spring.

Because of the spiral inclination of the passages through the seat, the water strikes the valve at an acute angle, tending to rotate it. When the valve leaves the seat, the plunger enters the spring collar, forcing the water within the cylinder of the spring collar out through angular ports and beneath the lower surface of the stem. This water forms a film between the stem and the collar, when the speed is normal, reducing the friction and allowing the valve to rotate. Therefore, with each stroke of the piston, the valve rotates a fractional amount be-

tween two films of water, but sufficiently to result in the uniform wear of the valve, and also a tight seat. The rotation of the valve at each opening is the basic principle of the valve. The device is the invention of the late John Robotham, and is manufactured by James Boyd & Bro., Philadelphia, Penn.

Drift Mining Fairbanks Frozen Placers

A typical mining operation on deeply frozen placer ground in the Fairbanks district is described by F. S. Katz in Bulletin No. 525 of the U. S. Geological Survey. In the middle of a 500-ft. block of paystreak averaging 100 ft. wide, a shaft 6 ft. square in the clear, cribbed with spruce poles chinked with moss, is sunk 182 ft. to bedrock, several feet being removed from the rock so as to provide a sump. From the shaft, about the center of the paystreak, the main level is driven up and down stream, timbered with sets of undressed spruce posts and caps set in the bedrock without sills, round spruce poles being used for lagging. At the end of this drift, crosscuts extend to the limits of the paystreak, from these the ground is stoped back toward the shaft. Other crosscuts are driven for prospecting purposes at different points. The face of the stope returning is kept in advance at the sides of the paystreak and somewhat behind at the main drift, so that when the shaft is reached, a rhomboidal pillar of ground remains. The auriferous gravel is about 30 in. thick. Since the bedrock surface is uneven, it has to be taken out in places to preserve grade. The drifts are about 5½ ft. high. The solidly frozen ground is thawed with steam points driven just above the bedrock and 2½ to 3 ft. apart, depending upon the amount of moisture in the gravel. Thawing and extraction take place on alternate days, operations being transferred from one end of the drift to the other. In this way, the ground is given time to cool before it is broken down. The broken material is shoveled into wheelbarrows, dumped from platforms into cars at the end of the gangways and the cars trammed to the shaft bottom. They are there dumped into the bucket, which has been lowered into the sump so that its rim is flush with the floor. It takes between five and six wheelbarrows to fill a car and a car fills the bucket. Operations are timed so that the loaded car is ready to dump as soon as the bucket has been lowered into the sump. The hoisting capacity of the plant thus determines the amount of work which is carried on underground. Working two 10-hr. shifts and employing 17 men, comprising a foreman, engineer, point-man and a gang of shovelers on each shift, there was hoisted about 250 buckets, equivalent to 80 cu.yd. of gravel per day, thus cleaning about 400 sq.ft. of bedrock. The bucket itself is not a simple mine bucket, but is combined with a trolley carrier so that after hoisting is completed, the bucket is run up an incline cable to a gin pole at the head of the sluicing arrangement. The bucket is provided with a guide yoke of wire cable or chain which travels on the guide wires as shown in the illustration. This keeps the bucket from spinning in the shaft and provides a device for tripping it into the dump box. The gold-saving apparatus consists, as in other mines, of a dump box and a string of sluice boxes. A 40-hp. boiler is used for hoisting and for pumping. The cost of the plant installed on the ground is said to be about $50,000, and the net cost of operation after all preparatory work was done was 50c. per bedrock sq.ft. The operation consumed 10 months. It is thus evident that the ground must run about $7.50 per cu.yd. to prove profitable.

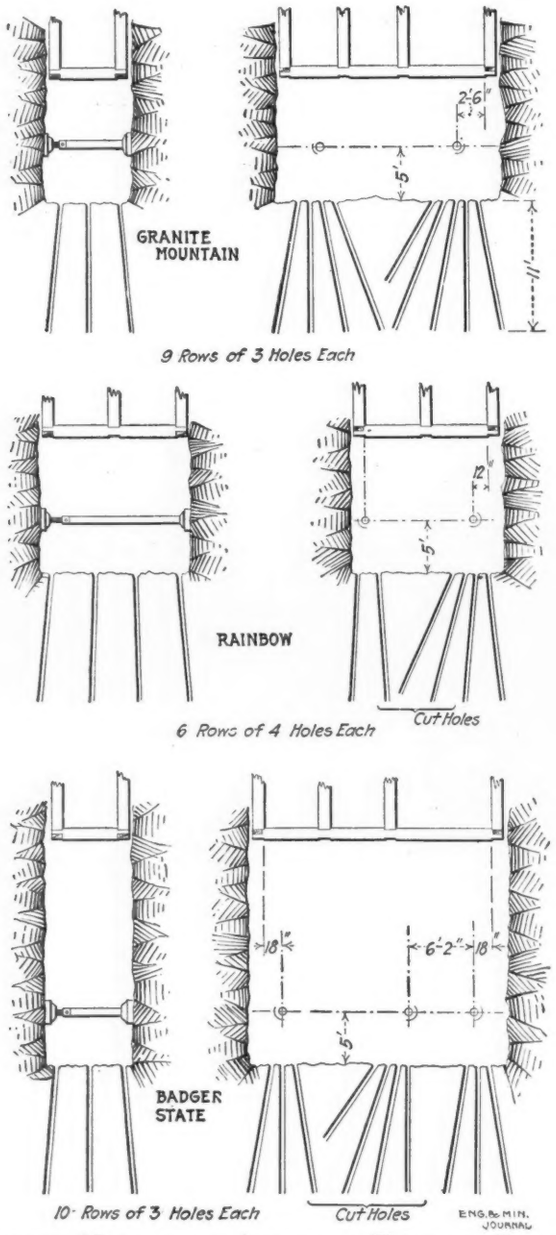


DRIFT MINING ON THE FAIRBANKS, ALASKA, FROZEN PLACERS

Flat, Tapered, Fiber Hoisting Ropes are used at the Grand Hornu coal mines in Belgium. The ropes are made of aloe (Agave Americana) fiber, and taper both in width and thickness. They are used in hoisting from a depth of 3280 ft., and at the large end measure 12½ in. wide and are 2 in. thick. At the cage end the ropes are 8½ in. wide and 1¼ in. thick. The weight ranges from 9.8 to 4.75 lb. per ft. The weight of each rope is 10½ tons. Each of the cages has six decks, and weighs 4800 lb., weight of the six cars is 2778 lb., the loads of coal total 6000 lb., making a total weight of 13,570 lb., not including the weight of the rope. The wind is made in 144 sec. actual winding time.

Butte Shaft Rounds

The piston machine is still the usual drill used for shaft sinking in Butte. Typical arrangements of the holes are given in the A. I. M. E. Bulletin, August, 1913. A 10-ft. hole is usual. In some shafts the whole round is blasted at once, but generally the cut holes in one or two rows on either side are blasted first, thus making



VARIOUS METHODS OF ARRANGING HOLES IN SINKING BUTTE SHAFTS

sure that the round will do its work. The cuts are sometimes mucked clear to bottom and the bottom of the cuts blasted with the rest of the round. At other places it is customary to muck down far enough to see that all of the holes are gone and then shoot the rest of the round. The men in this way are twice on top of a fresh muck pile and only pick bottom once for each 10-ft. round. Both 40% and 60% gelatin are used, the latter usually in the cut holes only. There is no ironclad rule governing the placing of the holes, but if the round is breaking out too far on one side, the holes are drawn in or one row omitted altogether. It is generally arranged that each machine shall drill the same number of holes and thus rivalry between the different runners is stimulated.

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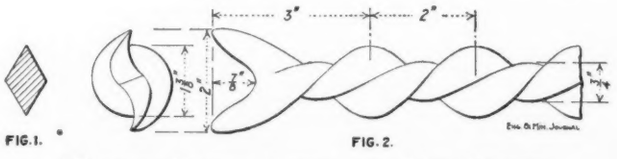
Machine-Driven Auger for Soft Ground

At the Barrows mine, near Brainerd, Minn., on the south range of the Cuyuna, W. J. Nicholas, the mine superintendent, has installed an ingenious drilling combination, consisting of a Jackhamer machine fitted with an auger bit. Soft ground has been usually considered unsuitable for the Jackhamer plugger type of machine, inasmuch as it tended to bury itself. It is evident that with an auger bit the difficulty is avoided, since the action of the twisted steel is that of a screw conveyor, rapidly clearing the hole of all cuttings. The rotation of the machine has a certain amount of drilling effect, but the speed of drilling is greatly increased by the hammering of the piston on the steel. A further advantage lies in the fact that when a hard rib is encountered, the regula-



MACHINE-DRIVEN AUGER FOR SOFT GROUND

tion rose-bitted hollow steel can be substituted for the auger until the soft material comes in again. The regular air pressure of 75 lb. is used with the machine.

The steel of which the bits are made is not twisted in the shop as in the case of hand augers, but comes twisted from the manufacturer. The original bar would seem to have a cross-section similar to that shown in Fig. 1. It is twisted so as to give one complete turn per 4 in., as shown in Fig. 2. The character of the bit forged by the blacksmith is also shown approximately. What may be called the greatest diameter of the twisted bar is about 1⅜ in. The bit of the starter has an overall diameter of 2 in. The other pieces of the set decrease about ¼ in. in gage and increase about 18 in. in length. The shank end is welded on in the shop; it is hexagonal and has a small collar to facilitate removal of the steel from the hole. It would seem to be important to ascertain before purchase that the steel had a direction of twist to correspond o the direction of the machine.

The performance of the machine is truly remarkable. It has made a record of six holes, averaging 4 ft. 8 in. each, drilled in 30 minutes, including changing steel and all incidental operations. This amount of work with the piston machine formerly used would have required at least half a shift. One man now does all the drilling for the mine, taking his outfit around to seven or eight places each day and still getting in from 100 to 150 ft. of holes per shift.

❖

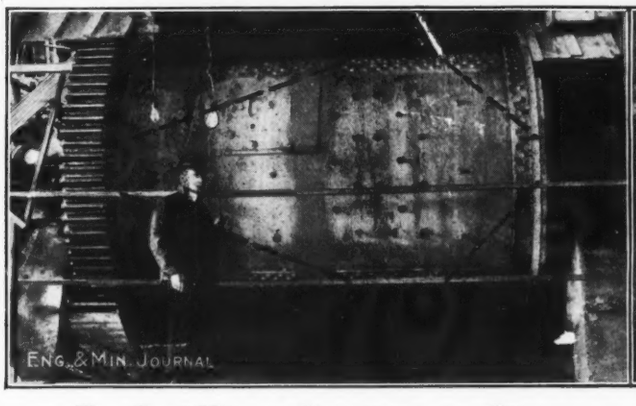
The Toximeter, a new French device, gives warning of the presence of carbon monoxide in mines through an alarm controlled by a thermocouple, which is affected by the heat produced by the oxidation of the CO inside a mass of spongy platinum.

DETAILS OF METALLURGICAL PRACTICE

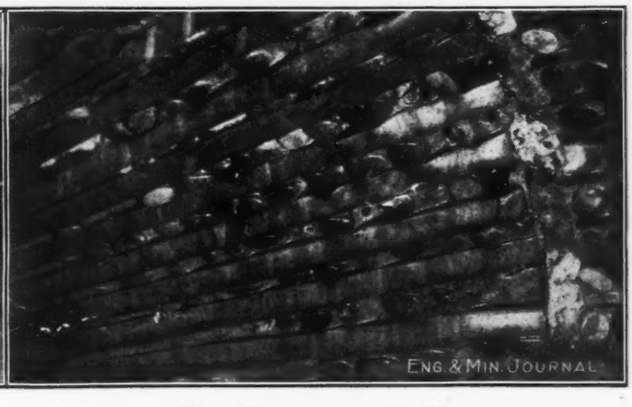
Changing a Tube into a Cone Mill

It is of particular interest that a 7x12-ft. tube mill, which was installed at the Morning mill of the Federal Mining & Smelting Co., Idaho, was so changed as to make it into a conical mill. The circumstances were that Hardinge mills were found to do better work than the cylindrical tube mills and they were installed, the tube mill being laid aside. Later, having need for more capacity, the tube mill was reclaimed and made into a cone mill.

Transition was effected by bolting heavy timbers inside the tube mill, forming a cone as shown by the dotted lines in the illustration. Over the timbers, steel rails were spiked or bolted to form a lining which resembles the El Oro ribbed type. Pebbles pack in the interstices between the rails, as with the El Oro lining, taking up most of the wear. The illustration shows the appearance of this lining after some use.



THE TUBE MILL AS CHANGED INTO A CONE



RAIL LINING IN THE MILL

Efficiency of the mill is shown in the accompanying table of screen classification of feed and product both before and after the change. The capacity of the mill before the change was 98.64 tons per day, while afterward it was 88.2 tons, a reduction of about 10.5%. The horsepower required before the change was 75.6, and afterward,

CLASSIFICATION OF WORK OF TUBE AND CONE MILLS

Before Change			After Change		
Screen	Feed %	Product %	Screen	Feed	Product
+10	29.5	....	+8	19.10	....
+20	45.5	....	+10	22.05	....
+30	12.0	0.5	+14	17.05	....
+40	6.0	0.5	+20	14.50	0.10
+60	4.0	2.5	+28	11.80	0.45
+80	1.5	5.0	+35	7.05	2.25
+100	1.5	8.0	+48	4.20	4.50
+150	....	5.5	+65	1.90	7.65
+200	....	20.5	+100	1.05	10.50
—200	....	57.5	+150	0.60	17.20
.....	....	....	+200	0.20	16.00
.....	....	....	—200	0.35	41.20

65, a saving of about 14%. It is probable, however, that the power stated as required before the change is underestimated. The revolutions of the mill were not changed, remaining at 22¼ r.p.m. in each case. Moisture in feed before the transition was 58.9%, and after it, 57.7%.

The change made by transforming this machine into a conical mill would probably infringe the Hardinge rights, but the controllers of the latter issued a special license to cover the case, a procedure which they offer to follow, within certain conditions, wherever mill owners desire to make a similar change.

❖

Payne Pneumatic Concentrator

Under No. 1,688,162, Clarence Q. Payne, of New York, has been granted U. S. patent upon a pneumatic concentrating table for handling dry pulverized ore. The machine consists of a table, much like other concentrating tables, rectangular for about half its length, and from that point reducing in width until it finally reaches about one-third of that with which it began. The table has the usual head motion, but differs in that it is rectangular, as has been explained, and has an inclination toward its discharge end. Transversely the table is level. The inclination is only sufficient to allow the ore to slide over the table and be discharged at the lower end.

The table top is made of porous silica plates which allow the passage of air through it. Underneath the table is a reservoir, constructed of sheet iron, into which air under pressure is admitted, this pressure passing up through the porous silica table top. At the end of the table, in the narrow portion, where discharge takes place, there are two splitting plates, the object of which is to divide the discharge into three portions.

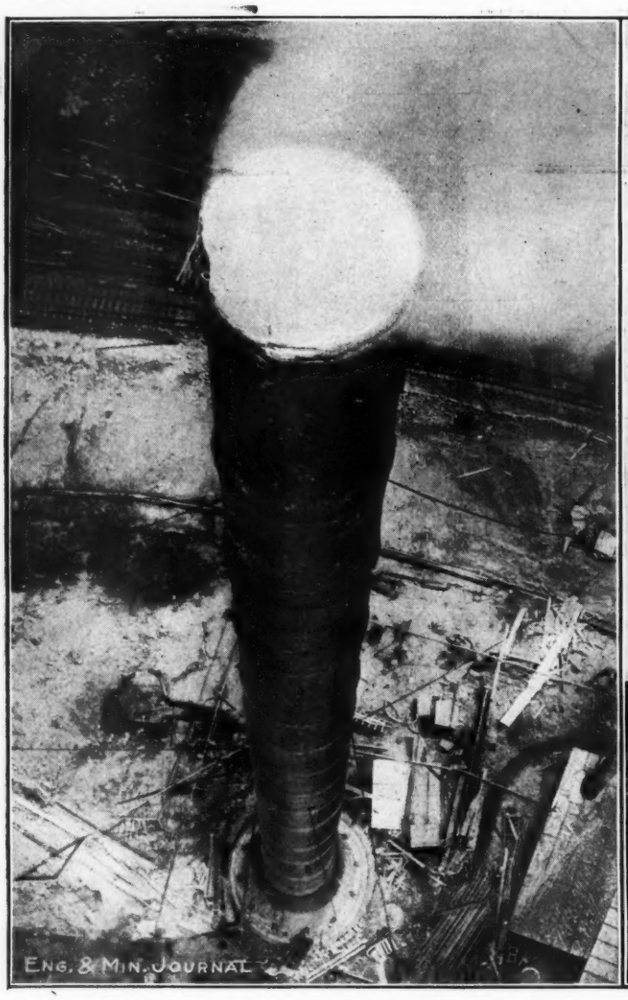
It will be understood that by giving the table a shaking motion and passing a light current of air through the porous top, the content of the table will be stratified, leaving the heaviest portions next to the table, the middle portions lying upon that, and the lightest portion on top. At the discharge point, the splitting plates, which are simply flat sheets of metal, split the bed of pulverized ore into three portions, a lower portion, which constitutes the concentrates, the middle portion which contains middlings, partly concentrates and partly waste material, and a top portion, which is tailings. The tailings are discharged separately and run to waste, the middlings reconcentrated and the concentrates retained. By reason

of the different lengths of these splitting plates, it is easy to discharge the three different products into three different receptacles.

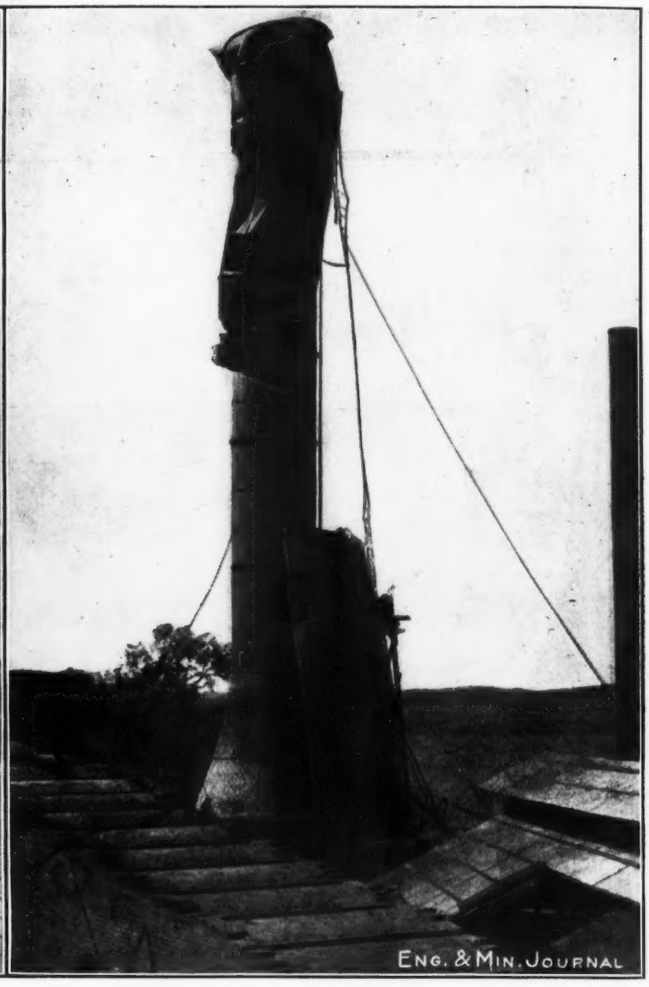
Replacing a Steel Stack with One of Concrete and Brick

The accompanying photographs illustrate the erection of a brick-lined concrete furnace stack for the Mountain Copper Co., Ltd., Martinez, Calif. It had been evident for some time that the capacity of the old steel stack was too small for the furnace and converter installation. Furthermore, the stack had previously seen service at Keswick, Shasta County, where the company formerly conducted its smelting operations, and a large portion was soon going to need reconstruction. The directors therefore decided to erect a concrete stack.

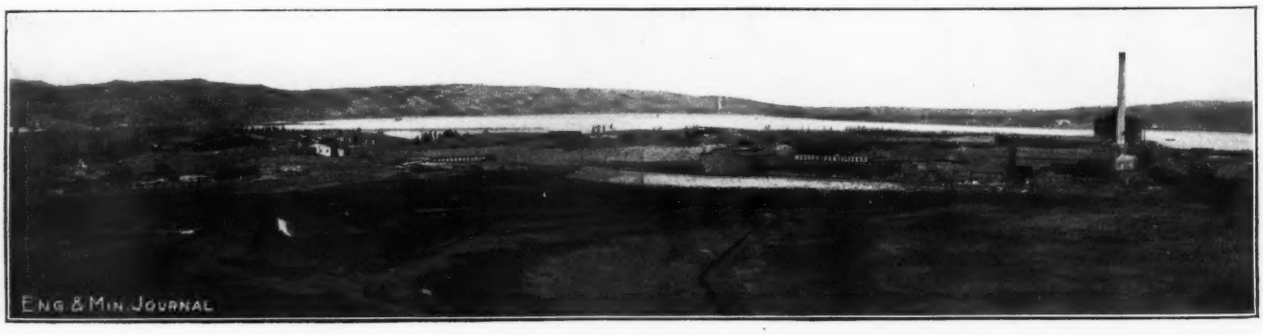
The stack was designed and built by the General Construction Co., Chicago, from company specifications prepared by Robert M. Schorr, of San Francisco. It is 223 ft. in height and its foundation is 75 ft. above sea level.



THE OLD STACK SEEN FROM THE TOP OF THE NEW; THREE OIL-FIRED REVERBERATORIES AND CONVERTERS IN OPERATION

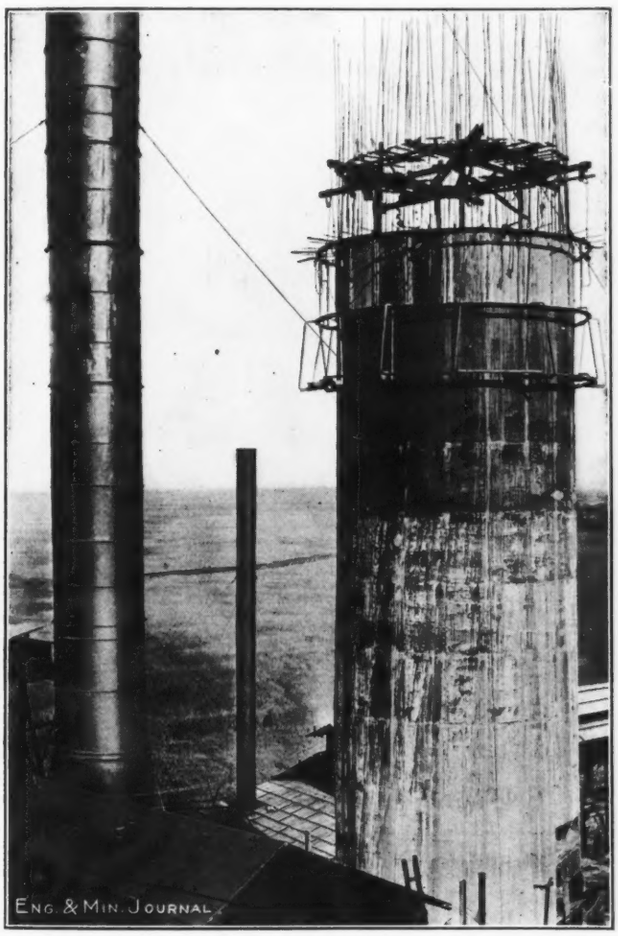


OLD STACK BROKEN AND BUCKLED AS THE RESULT OF A WINDSTORM



GENERAL VIEW OF THE PLANT

The foundation is octagonal, 35 ft. in diameter and sunk 5 ft. 6 in. below grade; it is heavily reinforced by two mats of twisted steel; the vertical reinforcement of the stack is embedded in this foundation and every second bar is bent under the lower mat. The vertical steel is surrounded from top to bottom with heavy woven-wire fabric tied to the steel bars and the entire reinforcement is calculated to absorb all strains resulting from a wind velocity of 125 miles per hr. on a basis of 16,000 lb. per sq.in. working stress. The reinforcement can be seen in one of the photographs. The concrete wall is 15 in. thick at the bottom and 5 in. at the top; the outside diameters are 19 ft. 4 in. and 13 ft. 10 in., giving an outside taper of 3 in. per 10 ft. The brick lining is a vertical barrel of hard-burned red brick, 12 ft. inside diameter, 8½ in.



NEW STACK IN PROCESS OF ERECTION; 11 SECTIONS, 55 FT., CAST WITH THE FORMS HOLDING THE TOP SECTION

thick for 140 ft. and 4 in. thick for the rest of its height; this barrel is strengthened by six 185-ft. pilasters built into it and clearing the concrete by about 1 in. The bricks are laid up in an acid-proof cement consisting of amorphous silica and finely ground quartzite sand, tempered with silicate of soda solution diluted with water. This cement the company has demonstrated to be entirely free from the sulphatizing action which furnace gases have on other mortars; it also sets quickly and completely and makes a strong bond.

Steel forms were used in pouring the concrete and were raised by means of chain-blocks supported from scaffold timbers which were run up on the inside of the stack; the green concrete thus had nothing but its own weight to support. These forms made a section 5 ft. high, and after the first few days one section was poured each day. The forms were set for the first course on Mar. 16, and the last course was poured on May 5; the stack was completed May 24. The mixture was portland cement, sand and furnace slag crushed to about 1-in. ring size, in the ratio of 1 : 2½ : 3.

While the steel stack should have stood up for some time, an exceedingly high wind on May 26 accentuated a slight buckle about 75 ft. from the top and this section worked around on the buckle until it collapsed; the top section in falling pulled down another 40 ft. with it, bending this latter over the standing portion of the stack and bottling the works completely. Starting up three days later, it was found possible to cut in furnaces and converters on different dates and so heat up the stack gradually, until on June 11, operations were in full swing again, and under greatly improved conditions. The greater capacity of the stack makes it possible to admit considerable false air, thus cooling and diluting the gases. So far, there is no noticeable effect from the passage of the hot gases, which have a temperature of about 350° C. at the base of the stack and have an SO_2 content of between 0.3% and 0.4%.

The view of the old stack from above while in operation and of the same stack after its collapse are of rather unusual interest. For the photographs and the description of the operation the JOURNAL is indebted to Thomas B. Swift, works superintendent, and William F. Kett, general manager of the company.

Basic-Lined Copper Converting

According to E. P. Mathewson ("Bull. A. I. M. E.," June, 1913), the first successful introduction of basic linings for copper converters on a large scale occurred at the American Smelting & Refining Co.'s plants at Perth Amboy and Omaha, as a result of the experiments, at Baltimore, of E. A. C. Smith and William H. Peirce, of the latter city. At about the same time, magnesite lining was introduced at the Anaconda company's Washoe and Great Falls plants; at present, practically all the bessemerizing of copper matte in the United States is done in basic-lined converters. The main points to be observed for successful operation of basic converters are: (1) Not to exceed a temperature of 2100 deg. F. (2) Not to use tuyeres smaller than 1¼ in. in diameter, 1½ in. being preferred. (3) To drive in punching rods, the full size of the tuyere opening immediately after pouring copper. (4) To maintain in the converter as large a mass of matte and slag as possible, to prevent sudden changes of temperature and overheating of the lining. (5) To employ a slag containing preferably about 25% silica.

To ascertain whether the cutting action of slag on magnesite linings was affected by the proportion of silica in the former, analyses were made on 13 slags from basic converters, ranging in silica from 22.4 to 37.8%; in copper from 1.80 to 4.60%; in FeO from 46.3 to 58.3%; and in lime from 0.9 to 1.4%. The magnesia in these slags ranged from 0.4 to 0.8%, the percentage bearing no apparent relation to that of the silica nor of any of the other ingredients.

THE COST OF DOING THINGS

Storage Battery Haulage Costs

A description of the storage-battery haulage system in use at the Big Five tunnel at Idaho Springs was published in the JOURNAL, December 30, 1911. The accompanying tables of cost, giving a comparison with horse haulage, are of interest.

The power cost from March to September, inclusive, as given in Table I, was a minimum, based on the maximum demand, and was in excess of the actual consumption at kilowatt rate. There costs also include the cost of current for two arc lights and for 12 incandescent lamps during winter evenings.

TABLE I. POWER COST FROM DECEMBER, 1911, TO SEPTEMBER, 1912

	Power consumption in kilowatts	Ton-miles	Power cost
December	2,677	4,451.5	$32.21
January	2,390	4,490.6	55.60
February	2,690	4,832.0	58.30
March	1,080	2,072.0	48.90
April	800	1,632.3	44.50
May	880	1,435.2	42.20
June	1,160	1,838.3	42.20
July	900	1,307.2	42.20
August	870	710.2	42.20
September	630	657.0	40.90

In Table II, the cost of superintendence and of discount to patrons is not included. The cost of material and repairs for the locomotive is excessive, owing to the fact that much difficulty was experienced with the carbon lights used, moisture in the tunnel making frequent short circuits and burning out lamps and sockets. The costs for April and May would be an average. Probably a fairer comparison of relative costs would be the figures for July, September and October for horses, and for December, January and February with locomotives, making an arbitrary figure of $15 per month for repairs and material, including the sand used.

TABLE II. COST OF HORSE HAULAGE

Month	Labor	Teams	Total	Ton-miles	Cents per ton-mile
May, 1911	$172.00	$96.08	$268.08	2147	12.5
June	222.45	136.87	359.32	3515	10.2
July	291.20	199.60	490.80	4290	11.4
August	399.75	213.48	613.23	5901	10.4
September	299.10	181.45	480.55	4621	10.4
October	326.95	143.80	470.75	4921	9.6
Totals	$1711.45	$971.28	$2682.73	25,395	10.6

COST OF STORAGE-BATTERY LOCOMOTIVE HAULAGE

Month	Labor	Material	Repair	Power	Total	Ton-miles	Cents per ton-mi.
Dec., 1911	$200.50	$27.56	$6.62	$56.21	$290.89	4452	6.5
Jan., 1912	192.25	41.36	12.78	55.60	301.99	4491	6.7
Feb.	259.75	21.40	10.96	58.30	350.41	4832	7.3
Mar.	190.00	10.15	.....	48.90	249.05	2072	12.0
Apr.	143.84	4.36	6.14	44.50	198.84	1632	12.2
May	111.67	8.50	1.75	42.20	164.12	1435	11.4
Totals	$1098.01	$113.33	$38.25	$305.71	$1555.30	18,914	8.2

⁂

Costs on Steam-Shovel Work

An example of the value of cost keeping on steam-shovel work is shown in a small contract carried out by the Aberthaw Construction Co., of Boston, says the *Engineering Record*. About 8000 cu.yd. of dry gravel, with a small percentage of boulders, were removed from a sidehill to make room for a building foundation. A ⅔-yd. Thew steam shovel was used for the work, the spoil being loaded into dump cars pushed by hand back and forth on a standard contractors' track 500 ft. long, carried on a trestle 10 ft. high. The average haul was 400 ft.

Although it is estimated by the contractor that this method saved 8c. per cu.yd., as compared with hand work, the cost was nevertheless 37½c. per cu.yd., the item of labor alone on the shovel work proper being practically 23c. The itemized unit cost was as follows:

EXCAVATION WITH STEAM SHOVEL

	Cents
Labor around shovel, pushing cars, unloading and spreading at the dump	22.9
Rental of shovel ($345) and repairs ($18.58)	4.5
Labor on track, including trestle	3.5
Labor for unloading, placing, etc., at the job	3.1
Rental of track	1.4
Labor at Boston end (including riggers' bill)	1.25
Freight on shovel and parts (both ways)	0.85
Total	37.5

⁂

Cost of Sinking Brakpan Shafts

At the Brakpan mine on the Witwatersrand two large rectangular shafts were sunk for hoisting and ventilating purposes. A description of the operation given by Charles B. Brodigan (Sir Clement Le Neve Foster Memorial Lecture) includes the summary of costs presented in the accompanying tables. Shaft No. 1 begun Sept. 26, 1905, and reached the reef at a depth of 3098 ft., Sept. 30, 1907.

TABLE I. COST OF TEMPORARY PLANT

Boiler house	$2,189.00
Engine house	2,590.00
Boilers, etc., including erection	20,921.00
Engines, etc., including erection	22,523.00
Sundry offices and sheds	635.00
Change houses	3,595.00
Headframe, including foundations	5,598.00
Signals	208.00
Pulleys	2,416.00
Ropes for whole period of sinking	6,435.00
Doors, safety and flap doors	291.00
Kibbles and bailing tanks	1,745.00
Crossheads for whole period of sinking	1,139.00
General fittings	400.00
Painting	114.00
Chutes	264.00
Dismantling	699.00
Total	$71,862.00

TABLE II. COMPLETE COST OF SHAFTS

	No. 1 shaft 3,098 ft. to reef. (3,129 ft. total depth.)	No. 2 shaft, 3,696 ft. to reef. (3,777 ft. total depth.)
Sinking	$258,930.00	$278,207.00
Hoisting	36,570.00	57,121.00
Timber, including bratticing and guides	175,075.00	210,191.00
Surface handling	20,488.00	27,717.00
Pumping and bailing	18,465.00	29,325.00
Total	$509,528.00	$602,561.00

This gives an average sinking rate of 126 ft. per month over the entire period. Shaft No. 2 proceeded slowly to the depth of 1143 ft. on account of a scarcity of labor and delays in delivering sinking equipment. From this point, until the reef was reached at a depth of 3724 ft., an average rate of 152 ft. per month was maintained.

Drilling was done by hand and buckets were used. The shaft contained seven compartments and broke a rock section of 9x43 ft. Timber sets were placed, the wall plates being 9x9 in. and the other members of corresponding dimensions. The equipment included two 15x30-in. double-drum geared hoists for shaft No. 1, and two 16½x 33-in. similar hoists for shaft No. 2. Each boiler plant at first included three 125-hp. fire-tube boilers, with a later addition of a 250-hp. water-tube boiler. The water flow was not heavy, but to handle what water was encountered, reciprocating-pumps actuated by compressed air discharged into rings built at suitable intervals in the shaft timbering.

TABLE III. COMPARISON OF COST OF SINKING FOR ONE MONTH IN GOOD AND HARD GROUND

		Footage	Explosives	Drill steel and tools	Guides	Timber	White and native wages	Steam power	Drill sharpening	General	Total	Cost per foot
Good Ground	Sinking	204	$1,372.00	$300.00	.....	.....	$10,131.00	$847.00	$166.00	$1,576.00	$14,392.00	$70.50
	Timbering	210	.....	18.00	$2,680.00	$3,951.00	1,899.00	.....	.....	99.00	8,647.00	41.08
	Total		$1,372.00	$318.00	$2,680.00	$3,951.00	$12,030.00	$847.00	$166.00	$1,675.00	$23,039.00	$111.58
Hard Ground	Sinking	120	$851.00	$340.00	.....	.....	$9,203.00	$1,262.00	$247.00	$875.00	$12,513.00	$104.27
	Timbering	127	.....	.....	$1,801.00	$2,523.00	1,173.00	.....	.....	126.00	5,623.00	44.28
	Total		$851.00	$340.00	$1,801.00	$2,523.00	$10,376.00	$1,262.00	$247.00	$1,001.00	$18,136.00	$148.55

TABLE IV. SUPPLIES CONSUMED IN SINKING NO. 1 SHAFT

Miscellaneous	Quantity		Value
Gelatin	103,000	lb.	$21,760.00
Detonators	114,000		658.00
Fuse	59,167	coils	6,677.00
Drill steel	65,834	lb.	4,613.06
Shovels	648		482.00
Picks	367		200.00
Hammers	796		341.00
Sundry tools	.....		896.00
Illuminants:			
Carbide	133	cwt.	986.00
Kerosene	1,805	gal.	520.00
Sundries, lamps, electric globes, etc	.....		737.00
Timber:			
Shaft sets	44,000	cu.ft.	55,956.00
Blocks, lagging wedges	20,628		16,267.00
Bratticing	24,961	running ft.	2,701.00
Steel and Iron:			
Guides	826		32.50
Hanging bolts	452	sets	6.05
Steel and iron	32,473	lb.	81.00
Sundries	.....		11.35
Total			112,924.90

El Oro Mining & Railway Co.

According to the annual report of the El Oro Mining & Ry. Co., El Oro, Mexico, for year ended June 30, 1913, the mills treated 433,708 tons consisting of 253,434 tons of ore and 180,274 tons of tailings. The average assay value of the ore treated was: Gold, $5.81; silver, $1.39; tailings retreated, gold, $2.55; silver, $1.04; total, gold, $4.46, and silver, $1.25. The total value of the bullion realized was $2188.724, and the extraction was as follows:

EL ORO COSTS PER TON 1913

Mining, per ton mined		$2.09
Development, per ton mined		1.42
Milling, per ton treated		0.18
Cyaniding, per ton treated		0.78
Water supply, per ton treated		0.02
General expenses, per ton treated		0.20
Taxes, per ton treated		0.21
Total working cost		$4.90
Sundry expense, per ton treated		0.042
Construction, per ton treated		0.024
London expenses, per ton treated		0.024
Directors fees, per ton treated		0.031
Exchange loss, per ton treated		0.025
Total expenditure, per ton mined and treated		$5.046
Credits:		
From railroad, per ton treated	$0.326	
Interest, dividends, etc	0.095	
Total credits, per ton treated		0.421
Net expenditure per ton mined and treated		$4.625
Depreciation charged, per ton treated		0.280
Total charge, per ton mined and treated		$4.90
Total charge, per ton treated		$3.42
Total charge in 1911, per ton treated (no tailings handled)		$4.18

The average hoisting depth 1912–1913 was approximately 650 ft.

Theoretical, gold, 86.38%; silver, 72.28%; total, 83.29%; actual recovery of assay value by bullion: Gold, 90.67%; silver, 80.24%; total, 88.39%. The total cost of production is summarized in the following table:

The ore reserves were estimated to contain 448,053 tons of ore averaging $8.11 per ton in gold and 3 oz. silver. It was estimated that the tailings dump contained 198,005 tons of tailings for retreatment. The following additions to the plant were made: A new 500-gal. electric pumping plant on the 1600-ft. level; a second electric-power line from the substation to the deep levels was completed; a fan at the ventilating shaft; a conveyor belt for tailings to the mill, nine classifiers for cyanide plant; 14 precipitation boxes; near ventilating shaft, a new change house was added, a new cottage was built, and a drinking-water plant was erected.

Efficiency of Rand Labor

The efficiency of the employees of the Witwatersrand mines is apparently increasing, according to figures published in the annual report for 1912 of the Mines Department of the Union of South Africa. Thus in the year 1904-1905 there were employed per 1000 tons milled, 1.25 white men, and 9.7 colored men, including Chinese, giving a total of 10.95. In 1912, these figures had been reduced to 0.9 white men, 7.43 colored, giving a total of 8.24. Reversing these figures, the number of tons milled per year per man employed were, in 1904-1905, 801.9 per white man, 103.1 per colored man, and 91.3 per each employee. In 1912 the corresponding figures are 106.1, 136.3 and 121.3. Probably a large part of this increase is due to the introduction of machine drills and other mechanical appliances, rather to any increase in the ability or discipline of the working force itself. In fact it is commonly stated and believed that the quality of the Rand miners is deteriorating.

In connection with these figures, some of the typical wage rates are interesting. The shift bosses received 23s. 8d. per day at the end of 1912, and timbermen, 20s.; miners stoping with machines on contract got 28s. 1d., and on day's pay, 19s. 9d.; for hand stoping on contract they got 26s. 6d., and on day's pay, 18s. 11d. Development work paid rather better; the miners on machine contract work in developing received 36s. 2d., and on day's pay, 19s. 8d., while for hand work the rates were 27s. 2d. on contract and 20s. 2d. on day's pay. As might be expected, shaft sinking was the most remunerative employment, the rate for contract work averaging 44s. 6d., and for day's pay, 28s. 1d. Engine drivers received 21s. 7d. It will be noted that these wages are high; thus the day's pay rate for shaft work, $7, is far above the average in this country.

The Scott Quicksilver Furnace is estimated to cost $1000 per ton of daily capacity ("Mineral Resources of the United States," 1912). A 12-pipe furnace costs $1000 to $1500 and will treat about 1800 lb. daily. The pipes themselves cost $25 to $35 each.

Blast-Hole Drilling, Nevada Consolidated

SYNOPSIS—Description of the churn-drill methods used in drilling the overburden and ore for blasting at Copper Flat, Nev. Machines, equipment, disposition of holes, setting up, drilling, moving speed, supplies, repairs and quantities of explosives are covered. It is often expedient to move the churn drills on flat cars, using a locomotive crane for handling.

During 1912, a total of 3,981,221 cu.yd. of ore and waste were excavated by the Nevada Consolidated steam shovels. Practically all of this material had to be blasted.

On account of the height of the banks and the volume of material handled, either gopher holes or blast holes must be used in order to blast the ground.

Gopher holes are tunnels driven into the base of a bank with a crosscut on each side at the face, forming a "T." The explosives are placed in the crosscuts, tamped and exploded. A gopher hole is expensive to drive and cannot be efficiently tamped, thus necessitating the use of additional explosives. Blast holes are put down vertically through the bank and are about 6 in. in diameter. These are chambered at the bottom with explosives so as to admit a charge sufficient to break the ground. Blast holes are quickly and cheaply drilled, and can be well tamped. To blast the material excavated in 1912, 2306 holes, having a total footage of 64,846, were drilled in ore, and 2226 holes, aggregating 83,263 feet, were drilled in stripping. Of these holes, only two, amounting to 110 ft., could not be used.

Drills and Equipment

All blast holes are drilled with eight No. 5 and one No. 3 Keystone churn drills. These are all traction, coghoist drills. The drills have been remodeled slightly to suit local conditions. Jars are seldom required, consequently the string of tools is shorter than ordinarily. For this reason a shorter mast is used, thereby lowering the center of gravity. When moving from one hole to drill another the mast is left up and the lower center of gravity makes the drill less liable to tip on rough ground. All operating rods have been changed to levers and are put upon the inside of the bed instead of outside. The walking beams have been reinforced, and the spudding wheels on the beam are attached to steel I-beams. The material in several other parts is cast steel instead of cast iron, to withstand the rough usage to which they are at times subjected. Probably many of the alterations would be unnecessary if more experienced drillers were employed. Many of the men have not run a drill more than six or eight months, yet they drill as fast as some who have drilled for years.

Each drill has the following equipment:

200 ft. of 2-in. manila drill cable.
150 to 160 ft. of ⅝-in. wire sand line.
One standard Keystone rope socket.
One 4-in. or 4¼-in. by 20-ft. drill stem.
One 5⅝-in. No. 100 Mother Hubbard bit.
One 12-ft. sand pump (made from 4¼-in. casing at the shops at Copper Flat).
One 10-in. Keystone steam-driven blower.
One forge, consisting of a pipe 2x36 in. and a wood box 32x36 in.
One right-hand tool wrench for 3½-in. squares.
One left-hand tool wrench for 3½-in. squares.
One single-acting floor jack and circle.
Two No. 6 Barrett lever hoisting jacks.
One spectacle.
One anvil billet and block (a piece of 75-lb. rail, 1 ft. long, spiked to a 2x12-in. plank).
Three to seven 50-gal. barrels (three in summer and seven in winter).
Two gasoline torches.
Two 16-lb. sledge hammers.
One set small tools, such as machinists' hammers, wrenches, files, etc.
Small repair parts also usually kept on hand, such as extra water glasses, gaskets and pipe fittings.

The best length of drilling cable to use is 200 ft. At least 125 ft. are needed if the mast is to be lowered or raised. The rope will wear most where it is in contact with the spudding pulleys and sheave pulley, and in time must be spliced. Three splices will shorten the rope about 40 ft. After a rope has been worn out there is about 60 ft. of good rope left on the drum. Generally this 60 ft. can be spliced to a rope having three or four splices, making a practically new rope for that drill. The other drill receives a new cable. By careful manipulation much rope can be saved in this way, and 200-ft. lengths are best suited for this purpose.

Bituminous coal is used under the boilers, and water is delivered to the drills by pipe lines from springs eight miles distant. The crew consists of one driller and one tool dresser. A coal boy supplies two drills with coal from piles placed about every 100 ft. along the bench, and he also shovels the coal from standard coal cars to make new piles. The drills are operated for two shifts of 10½ hr. each day in every 24 hours. The day shift starts to work at 7 a.m. and at noon stops for lunch. Work is resumed at 12.30, and continues until 6. The night shift starts at 7 p.m., and follows the same schedule as the day shift.

Hole Spacing

All blast holes are drilled to a depth of from 3 to 5 ft. below grade, i.e., a hole of 55 ft. in depth is drilled for a bank 50 ft. in height. This removes all danger of the steam shovels encountering unbroken rock. The holes are spaced about two-thirds of their depth apart. The slopes of the banks average 45°, thus the edge is back from the toe below, a distance equal to the height of the bank. Holes for a bank 50 ft. in height are drilled to a depth of 55 ft., are spaced about 37 ft. apart, and are put as close to the upper edge as they can be conveniently drilled; generally about 10 ft. from the edge, or 60 ft. back from the base.

Setting Up Drill

After a drill has completed a hole and moved to the next spot, the rear wheels are made as nearly level transversely as possible; one wheel being run up on blocking if necessary. Usually blocking is not needed, but occasionally a rough piece of ground is encountered. The wheels are then blocked to prevent the drill from moving and the traction pin is removed. Two track jacks are placed beneath the front end of the bed, and are used to relieve the front wheels of the weight they usually support, as well as to level the front end of the drill trans-

Note—Excerpts from an article by W. R. Brown, reprinted by the "Colorado School of Mines Magazine" from the "Keystone Drill Magazine."

versely. Transverse leveling is imperative in order to keep the belt on the pulleys while the machine is running. If it is possible to drill at all, no attention is paid to longitudinal leveling. Drills are sometimes operated with the tools hanging almost to the end of the A-frame tool-guide, and, again, with scarcely any room between them and the front of the machine. It is well, however, to have at least 2½ ft. between the front of the drill and the tools. It is well to remember, in blast-hole drilling, that much valuable time may be lost in attempting to level a drill longitudinally.

Drilling Methods

A 4-ft. piece of 7⅝-in. casing is used to guide the tools when drilling is started. This has two coils of old 2-in. drilling cable wrapped about it to prevent it from sinking into a hole, also to furnish a hold in removing it after the hole is finished. This short piece of casing is locally known as a "conductor." As mentioned above, the ground is blasted from 3 to 5 ft. below grade, so, for a few feet, the holes are drilled in broken ground. The "conductor" keeps this broken ground from falling into the hole. Until the hole is 4 or 5 ft. deep the drill must be run relatively slowly, but, below this depth, it is run at a speed of about 58 drops per min. The hole is bailed out every 2½ or 3 ft. and the sludge is allowed to run down the bank below. After the hole is completed, the tools are pulled up as far as possible, and are tied to the bed of the machine in order to prevent them from swinging while the drill is moving. The dart of the bailer is tied to the rope on the conductor and the conductor is pulled out of the hole. The bailer, or sand pump, is hauled up into the A-frame, which prevents it from swinging enough to do any damage. The track jacks are removed, the traction pin is put in place, the blocks removed from the wheels and the drill is moved to the next spot.

Moving the Drill

When it is necessary to move a drill from one bench to another a considerable distance or to enter or leave a place difficult of access, a locomotive crane of 30 tons capacity is used. Three chains of proper length are used to take a hold on the drill; one is attached just above the front axle and the other two are attached to the two rear wheels. The mast is not lowered, nor are the tools taken off the machine; the fire is not drawn and the boiler is not blown out. In fact, the machine is ready for work as it is loaded upon a flat car. A barrel of water is put in the bed of the drill and all other equipment is put upon the flat car. When the drill is unloaded it simply moves to its place and starts drilling. The barrel of water is used until a pipe line is laid to the drill, so that no time is lost after the drill is placed upon the ground.

Formerly, all moving was done by preparing roads and running the drill on its own power. The advantages of moving a machine with the crane are that much time is saved in moving and that three men besides the driller and tool dresser, can move the drill with the crane, whereas at least 10 men are required otherwise, to make roads and move equipment. Frequently, also, when moving a drill under its own power, the drill has to travel a considerable distance along a track, and the rear wheels split many of the ties in so doing. The machine is jolted and strained appreciably, and the track is also tied up, thereby tying up a steam shovel. If it is absolutely necessary to move a drill by its power, the tools are tied underneath the drill and dragged along the ground. A barrel of water is put in the bed of the machine, and the rest of the equipment is generally moved on a push car.

Speed, Supplies and Repairs

The average drilling for a shift of 10½ hr. is 60 ft. William Gibson now holds the local record of seven holes, 25 ft. in depth, drilled in one shift. This was done in midwinter, with the thermometer well below zero. During the month of August, 1912, a series of holes 15 ft. deep were drilled by one drill, which aggregated 2745 feet.

A working steam pressure of 100 lb. per sq.in. is used on all drills. The consumption of coal amounts to 600 lb. per shift. Twelve 50-gal. barrels of water will supply the boiler and the drill hole for one shift. The following lubricants are required: ½ pint engine oil, 1 pint valve oil, $^5/_7$ lb. cup grease per shift; ½ gal. of gasoline per night shift.

The drills receive harder usage than that for which they are designed, and more or less repairs and renewals are necessary on that account. The use of the crane in moving has materially cut down repairs. By carefully noting the parts which break most frequently, and either changing the material of which they are made or increasing their size, renewals have been reduced to a great extent. Repairs are made in the field until the drill loses its efficiency. It is then taken to a well equipped machine shop, entirely dismantled and rebuilt. This allows all defective pieces to be noted and replaced properly.

Explosives

To those not familiar with blasting large quantities of ground, a few words concerning that phase of the work may be appropriate. The friability of the ground is the chief factor. No set rules can be given for the most efficient use of explosives; the amount and kind must be determined by much experimenting. However, the following may be used as a basis upon which to start experiments: For holes 45 ft. in depth, use 10 sticks of 60% Semi-Gelatin Red Cross powder to start chambering; triple the amount for each succeeding chambering charge, i.e., first 10 sticks, then 30 sticks, then 90 sticks, etc., until the chamber is large enough to receive the blasting charge; for the blasting charge use 25 lb. of black powder for every foot of hole; for holes 90 ft. in depth in solid hard rock, start chambering with 25 lb., 60% Red Cross powder, and triple each succeeding charge; tamp the first charge with 20 gal. of water and triple the tamping with each succeeding charge. The blasting charge is again 25 lb. black powder per foot of hole. A blast hole will break the ground in back of it about one-quarter the distance it breaks in front. By the front is meant the side offering the least resistance. All blasting and chambering should be done by electricity, using electric detonators recommended by the powder manufacturers.

The following explosives are in use at Copper Flat:

F F black powder for blast holes.

Stick Trojan No. 2, for blast holes in hard rock and for bulldozing.

Bag Trojan for blast holes.
Sixty per cent. Red Cross powder for chambering.
Forty per cent. Hercules powder for chambering in soft ground.

During the year 1912 the following quantities and kinds of explosives were used:

	Lb. per ton ore	Lb. per cu.yd. stripping
Hercules, 40%	0.0824	0.0910
Black F. F.	0.0762	0.2732
Stick Trojan	0.0689	0.1780
Bag Trojan	0.0439	0.1568
Gelatin, 60%	0.0019	0.0037
Red Cross 40% nitroglycerin	0.0059	0.0032
Red Cross 60% gelatin	0.0038	0.0031
Giant ammonia, 40%	0.0025	0.0015
Total	0.2855	0.7105

2.16 tons ore = 1 cu.yd.

These quantities include explosives used in "bulldozing," but in spite of that they show clearly the efficiency of blast holes.

Homestake Improvements and Lead Notes

SPECIAL CORRESPONDENCE

By the end of the year improvements costing nearly $250,000 will have been made by the Homestake Mining Co., and for the coming year the projected plans call for an expenditure fully as great. The big work this year has been on what is to be called "Recreation Hall." This building, located just beyond the business part of Lead, on one of the main streets, will include reading rooms, library, billiard rooms, bowling alleys, baths, etc., all of the privileges of which will be free to Homestake employees. In addition a wing is being built for an opera house, which will, when completed, be one of the finest in South Dakota. The building is modern in every particular, is built of stone, brick and steel, and would be an ornament to a city many times the size of Lead. The walls are practically complete, and probably by the time this is in print the roof will be on, and then there will be no danger of bad weather interfering with completion of the interior. Another large undertaking of this year was the construction of a commodious change-house at the Ellison hoist. This building was built of concrete blocks, and is a model structure in convenience and arrangements.

STEAM-DRIVEN AUXILIARY ELECTRIC PLANT

Work has already been begun on clearing the site and preparing for the erection at Lead of a steam-driven electric plant, to be used as an auxiliary of the Spearfish hydro-electric plant. The boiler house will be located near the Star mill, just north of the Homestake barns, and will contain boilers of a total capacity of 2000 hp. Just across the street and adjoining the transformer house and substation, will be erected a building to house the turbo-generators and other equipment. Steam from the boiler plant will also be used to operate the new Old Abe hoist, and to a limited extent in the mills in the neighborhood, for heating and other minor purposes. With this auxiliary generating plant in operation shutdowns due to a shortage of electric power will be minimized.

Another important piece of work will be the erection of a new hoisting plant at the Old Abe shaft. This plant will be the finest on the Homestake property, and capable of hoisting from any depth to which the workings may be driven in many years to come. It is expected that work on the new hoist will start about Apr. 1, 1914, as the machinery has already been designed and specifications for the new plant are in the hands of the contractors. There will be no delay once it is under way.

Lawrence County has received $4056, its share of the timber sales from national forests within the county during the last fiscal year. Of this amount $406 goes to the school fund and $3650 to the road fund. This payment was made in compliance with the new Federal law which provides that 10% of the proceeds of the sales of timber from national forests shall be paid into the treasury of the county where the timber is cut.

SUIT AGAINST THE LEAD UNION

There has lately been an interesting suit in the local courts involving the title of the Lead miners' union building, the plaintiff being the Western Federation of Miners through its president, C. H. Moyer. Title to the property is claimed by virtue of the terms of the Federation charter which provides for the forfeiture of all property of the local union on its dissolution. The suit is an aftermath of the labor struggle of several years ago in the Black Hills, at which time, according to testimony introduced in the case, the Western Federation paid out in benefits to its members in this district, a little over $40,000. The decision of the court was that the Lead miners' union was the sole owner of the property; that the Moyer deed was in law a mortgage only against the property, and for $8100; that this mortgage was subject to a prior mortgage for $25,000, given the Butte, Mont., union in 1911; that the Butte union, through the Federation, had forwarded to Lead, as relief, $25,000, the consideration for the giving of its mortgage; that no application having been made to the court to foreclose these claims against the property, the court had nothing further to do than to declare the effect of these instruments. The Lead union admitted an indebtedness of $13,100 to the Butte union, and will probably appeal from those parts of the judgment holding it liable for further sums.

Splendid progress is being made by the Mogul Mining Co. in the erection of its new mill near Terry, and, according to Constructing Engineer Woods, the mill will be ready by the middle of January. The building is nearly inclosed, and a few more days of good weather will see everything under shelter. About 25 men are employed on the construction.

Secretary Wilson's Address in Seattle

WASHINGTON CORRESPONDENCE

What is regarded here as a statement of the policy of the government here has been laid down by Secretary of Labor William D. Wilson, in his address to the American Federation of Labor, at Seattle, Washington, in which he asserted that the duty of the Department of Labor according to his view of the matter is that of mediation between employers and employees as part of a process of cooperating with the trades-union movement, inasmuch as "there can be no mediation, there can be no conciliation between employers and employees that does not presuppose collective bargaining, and there cannot be collective bargaining that does not presuppose trades unionism."

Secretary Wilson's announcement is regarded as notice of an intent on the part of the Department of Labor to undertake drastic action regarding the labor difficulties in the Michigan copper-mining regions. It has proved impossible to induce members of the administration to offer any open criticism of Secretary Wilson's ideas as thus expressed.

Tin Mining in South Africa

JOHANNESBURG CORRESPONDENCE

A small production of alluvial tin is still being made from the Kuilo River district near Capetown, Cape Colony. The Swaziland deposits are now being prospected by Empire drills and the deposits worked by modern methods. E. M. Weston was the first to introduce hydraulic elevators into that country and to sluice tin ore on a large scale. Several are now at work and electric elevators are being introduced to economize water power in elevating tailings. The Swaziland Tin, Ltd., is now producing about 40 tons per month with a profit of $4000. The deposits are unfortunately not really extensive and have had their richest portions worked for a total yield of about £300,000.

To the north of Pretoria, Waterberg tin fields continue to make large returns. The Zaaiplaats mine, working irregular pipe deposits and impregnations along fissures, is returning about 100 tons of concentrates per month at present and proves a favorite gambling counter, as little ore can be developed and the orebodies are most irregular; one deposit has been followed for 1500 ft. on incline. The neighboring Groenfontein mine has run out of rich ore in all its pipes and practically ceased production. In the felsite area bordering the granite, the South African tin mines have been producing 2% ore and running a 10-stamp mill with indifferent results. The ore occurs in fissure veins and disseminated. The Welquarden mine has developed 20,226 tons of 2.7% tin ore and is erecting a small mill. Some of this ore is as fine as flour and the SnO_2 is a light-yellow color.

In the quartzite area, the Rooiberg mine produced 70 to 90 tons of concentrates per month and is making large profits; developments are apparently satisfactory. The probable ore and developed ore was recently estimated at about 90,000 tons. The neighboring farm of Leeuwpoort was prospected by several syndicates without result, but the present company holding it has over 120,000 tons of 2.29% metallic tin developed. This ore is valued at from £300,000 to £400,000. An incline on the Spirit vein is down 652 ft. and shows a vein assaying 13% Sn over 7½ in. at the bottom. Old workings characterize this district. One of the lodes discovered was looked for only because of the discovery of a piece of isolated rich float.

The prospector persevered, though no trace of any further ore could be found. He sank a shaft eight feet through overburden and suddenly came on old workings which were extensive and deep. These had been worked from two shafts and all trace had been carefully closed up and filled in. Who these ancient workers were is a greater puzzle than those in Rhodesia. They smelted tin at Wooiberg and some ingot has been found. It is estimated that on this property there is an alluvial deposit of 2½ million cubic yards, valued at 2s. 2d. per cu.yd., which may be treated later. A mill to treat 4500 tons of ore per month is under construction.

Some further promising discoveries have recently been made on the Olefants River in the Cow Country of the Eastern Transvaal.

California Oil in September

The net production of petroleum in all California fields in September was 8,256,710 bbl., a decrease from August of 154,694 bbl. The daily average production for 30 days in September was 275,224, an increase in daily average over August of 3879 bbl. The total shipments and losses in September amounted to 7,314,358, a decrease from the total outgo in August of 351,683. The total stocks at the end of September were 49,865,908 bbl. There were small increases in production in McKittrick, Belridge, Whittier and Newhall, and an increase of nearly 100,000 bbl. in Midway. The remainder of the fields all showed a decrease except Los Angeles, which remained stationary.

Field operations in September showed 35 new rigs, 41 completed wells, 321 wells drilling, 373 wells on which drilling was suspended, 5950 wells producing, 1203 wells capable of producing but idle, eight wells abandoned.

SEPTEMBER CALIFORNIA OIL PRODUCTION BY FIELDS

District.	Bbl.
Fresno County—	
Coalinga	1,511,374
Kern County—	
Midway	3,178,672
Kern River	724,552
Maricopa	465,048
McKittrick	341,885
Lost Hills	279,786
Belridge	189,294
Total Kern County	5,179,237
Santa Barbara County—	
Santa Maria	393,165
Summerland	4,350
Total Santa Barbara County	397,515
Southern fields—	
Fullerton	514,575
Coyote-La Habra	287,771
Salt Lake	205,882
Ventura	68,365
Whittier	53,703
Los Angeles	26,905
Newhall	11,383
Total Southern fields	1,168,584
Total all fields	8,256,710

Major R. G. Leckie

Major R. J. Leckie, dean of Canadian mining engineers, died at Sudbury, Ont., Nov. 6, aged 80 years. He was born in Scotland, but had been a resident of Canada since he was 23 years old. He had been prominently identified with the mining industry in many highly responsible positions, such as managing director of the Orford Nickel & Copper Co., managing director of the Cumberland Coal & Iron Co., general manager of the Londonderry Iron Co. and others. He was one of the founders and first president of the old Federated Mining Institute. He has been vice-president of the American Institute of Mining Engineers and a prominent and valued member of the Canadian Mining Institute.

We expect to publish a fuller account of his life and services in our next issue.

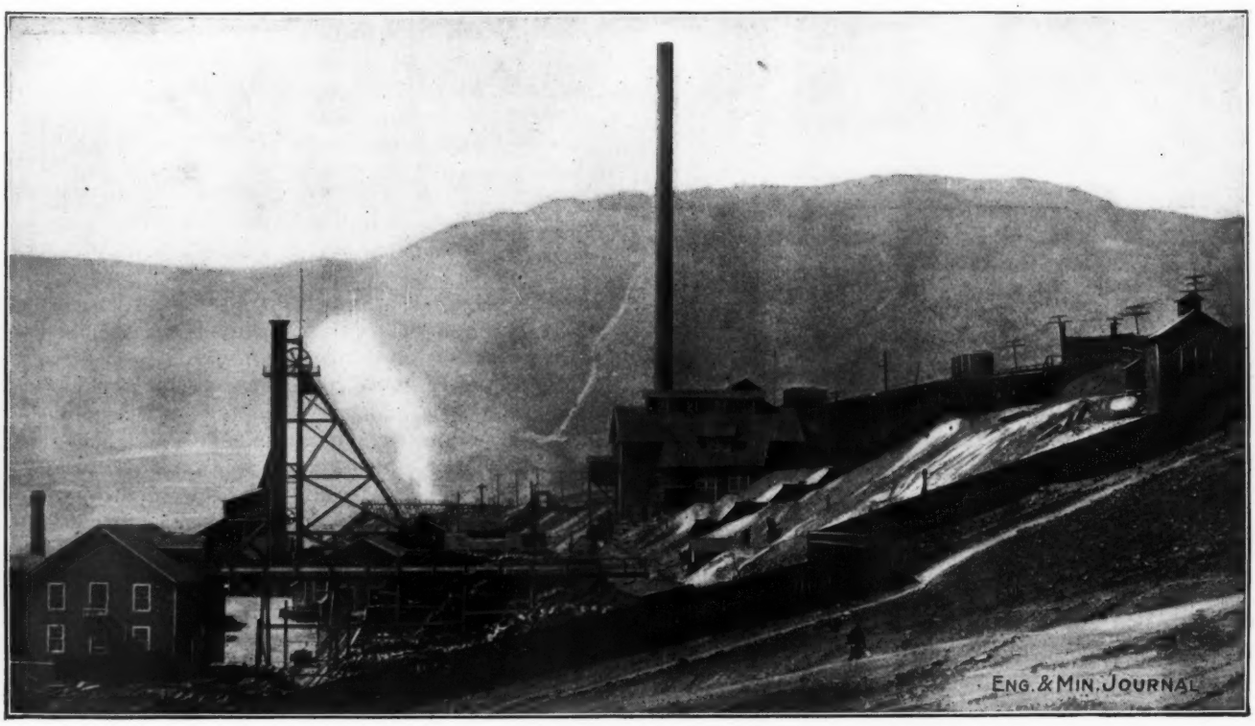
The M. M. S. A. Medal

The Mining and Metallurgical Society of America has awarded its gold medal for 1913 to Herbert C. Hoover and Lou Henry Hoover, in recognition of their distinguished contributions to the literature of mining. The presentation will take place in January next.

PHOTOGRAPHS FROM THE FIELD

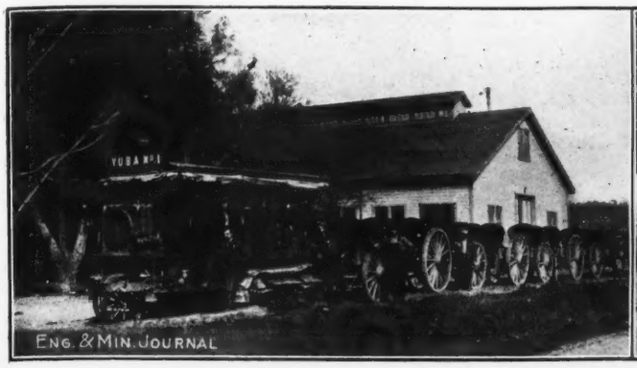
WEST COLUSA MINE AT BUTTE, PROPERTY OF ANACONDA COPPER MINING CO.

Levels are 100 ft. apart to depth of 1200 ft., thence 200 ft. apart. Three-compartment shaft was retimbered in 1910, false sets being used to obviate squeezing. Connections have been made with Mountain View, and Leonard mines. Fire from the Minnie Healy has caused trouble in the West Colusa; in February the fire reached the 600-ft. level and extended over an area equal to two city blocks, necessitating closing of the mine. The vein is 400 ft. wide in some places.



ANOTHER ANACONDA PROPERTY AT BUTTE, THE PENNSYLVANIA MINE

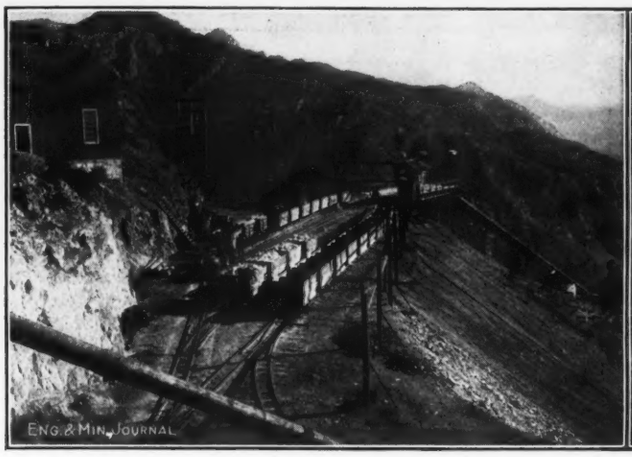
The main shaft has been sunk, three compartments wide, to the 2200-ft. level where stations have been cut on north and south sides. Water is raised to the 1200-ft. level and transported by a flume through a crosscut to the Mountain View mine, thence through a long drift to the Leonard mine, three-quarters of a mile away. It goes to a precipitating plant. Ore lies nearer surface than in most Butte mines.



HAULING A TRAIN OF DREDGE BUCKETS

BIG WHEELS FOR HAULING HEAVY MACHINERY

At Hammonton, Calif., caterpillar trucks do heavy hauling.

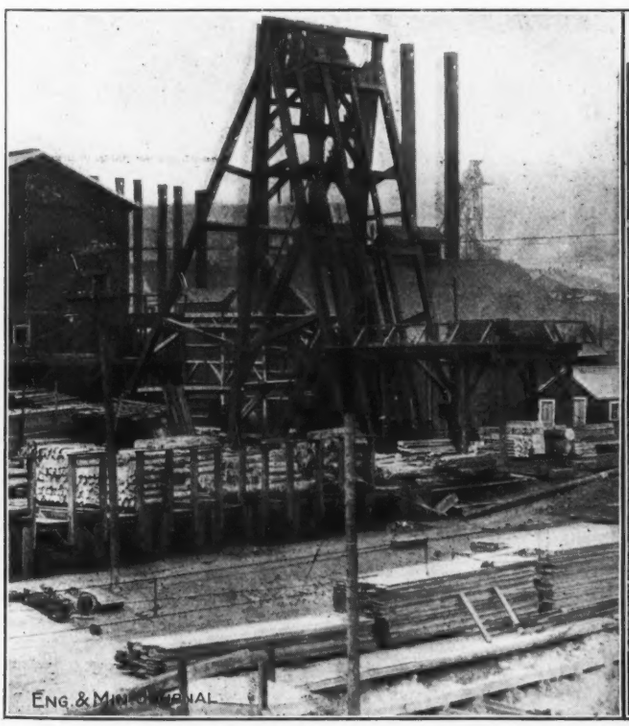


TOP OF LONGFELLOW INCLINE, MORENCI, ARIZ.

Electric haulage yards at one of the Arizona Copper Co.'s mines.

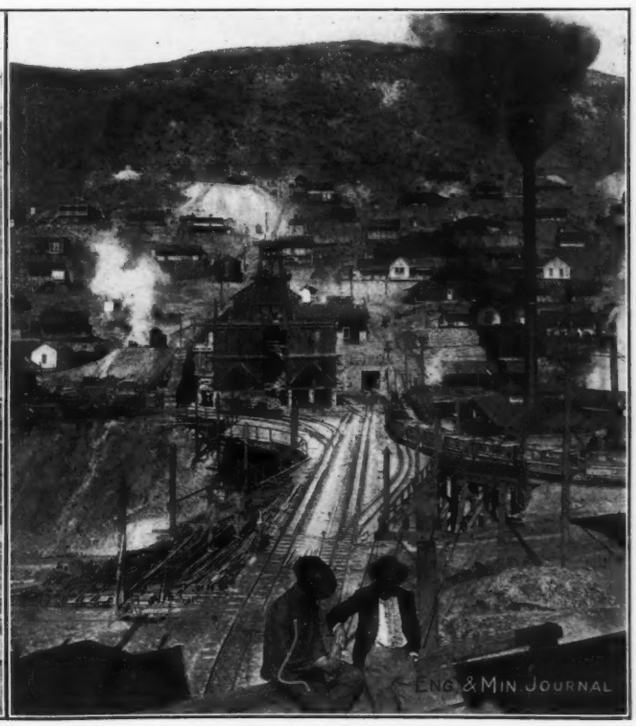
CORONADO INCLINE AT METCALF

The haulage rope broke this summer and a number of men were killed.



WEST STEWART MINE AT BUTTE

An Anaconda mine over 2100 ft. deep.



HUMBOLDT MINE, MORENCI, ARIZ.

Property of Arizona Copper Co.

CORRESPONDENCE AND DISCUSSION

Mining Enterprises in Peru

Some time ago the JOURNAL published the following from an American residing in Peru: "Mining enterprises, according to Peruvian ideas, consist of spending five soles in a denouncement and then waiting for a *gringo* to come along, who will pay out a fortune for a show on which the owners will not even go to the expense of perfecting their titles."

Though partly true, this statement tends to impart a wrong idea as to the reason why Peruvians content themselves with denouncing mining claims and then waiting for a purchaser. Neither are the Peruvians nor the conditions prevailing in Peru to blame for this way of doing business. On the contrary, the foreign investors are responsible.

In the past, when the Peruvians obtained mining concessions, the mines were opened at once and operations begun, so that it was an easy matter for an eventual purchaser to make a thorough examination of any properties he intended purchasing. But it happened, not only in Peru, but also in other countries, that mine owners who offered their mines for sale did so because they were lacking capital for operating the mines, as they generally had put the entire capital at their disposal into the preliminary work, so that when they could not sell these mines soon to some rich syndicate they found themselves without any means of subsistence. Then they had the only alternative to sell their mines at a price far below their real value or to starve. The investors were well aware of this fact and when mines were offered they would drag on the negotiations until the would-be seller saw no other way but that of selling at a low price.

I know of cases of the kind, in which the owners of rich mines, with titles in perfect order, came to the United States to put them on the market. The first thing the men who were approached with an idea of sale did was to get information as to the means of these mine owners. Once enlightened on this point, negotiations were initiated but were kept hanging until the day came when the vendors' funds were exhausted and they were forced to sell at any price.

Just now there is such a case pending. The mine in question is a rich copper mine, of an acknowledged value of $500,000. The Americans who pretended to be inclined to purchase the property dragged the negotiations along for eight months, and then suddenly broke them off because meanwhile they had learned that the means of the owner were limited and that in a short time he would have to accept their own terms. This kind of business is known as "Freezing out." In the specific instance mentioned the Peruvian mine owner has lost eight months and spent $4000. This practice is no longer unfamiliar to Peruvian mine owners. The result is that now the Peruvians content themselves with denouncing claims, paying the tax, and then waiting for a purchaser willing to share in the expense of perfecting title to the property and of the preliminary work.

The American who describes South America as the land of mañana must also be pleased to have his own country referred to in South America as the land of next week. This is due to the fact that so often in the past when a business proposition was presented to an American his reply would be, "Call again some day next week." The reputed quickness of Americans to close deals is no longer accepted as a fact in Peru.

The American in Peru would have done well to search for the reasons which have induced the Peruvians to alter their way of dealing in mines, and he would have found out that he has been confounding the cause with the effect, as is generally done when criticism is unjust. At all events, it is as easy to do business in Peru as it is in any other country, but prevailing customs of the country must always be considered. Another general mistake of Americans is to entrust the carrying out of a business in Peru to someone who knows neither the language nor the habits and customs of the country, and takes months to initiate negotiations which another with better linguistic gifts and knowledge of the country would have done in so many weeks.

O. SPERBER.

New York, Nov. 1, 1913.

Capital and Prospects

Recent years have produced a condition in the mining industry that threatens to become acute. It would, perhaps, be unjust to term it one of pessimism, but its influence on the business is as enervating as though capital had determined to take nothing but a gloomy view of all unproved properties.

One reads, from time to time, in the periodicals devoted to the mining profession, tabulated accounts prepared by exploration companies and others, giving the number of properties submitted for their consideration. This is followed by a statement of the number deemed worthy of a preliminary examination. The next item sets forth those that meet the requirements necessary to warrant a more detailed study of their possibilities. Finally the list is rounded out with a figure representing those that are taken over on some basis for further development. Where the initial number of properties submitted is apt to reach a total well over 500, the final figure in the list is quite likely to be extremely small or to vanish altogether.

Since there is a reason for all things there must be one for this. It does not seem possible that the gigantic strides made by mining in the last 20 years are altogether responsible for the dearth of desirable properties. One admits, of course, that the great growth of the industry has had its effect, since ore deposits are not the product of a season like a farmers' crop, and hence must ultimately

become exhausted both as units and as an aggregate, but of equal importance to this exhaustion of resources as a preventive to the discovery of new mines is the attitude of capital. Overlooking the probable magnitude of the returns upon its investment, should its mining venture prove a success, it demands at the outset a factor of safety that is excessive. It seeks, in a measure, to protect itself as it would in a bond investment, with this difference, however; it expects not only a high rate of interest, but a comparative lack of risk.

This demand is reasonable and right when not carried to an extreme. But the tendency today seems to be to overdo it. While willing and eager to reap large dividends, capital hesitates to gamble. Yet to make a success of mining a certain amount of gambling instinct is not only desirable but necessary. I am not speaking now of investments in developed properties where ore reserves permit, to a certain extent, the calculation of future dividends, but of properties in the prospect stage.

Would the Tamarack shaft have been sunk approximately a mile if those interested had not gambled that the lode at that depth would not be impoverished and would still carry copper in amounts to make their venture justifiable? Would any property in Tonopah outside of the Tonopah Mining Co. have become a producer as early as it did unless it had "taken a chance" and gambled on finding ore below the capping that covers the greater part of the Tonopah area?

Of course, capital immediately replies that the Tamarack was reasonably sure of intersecting ore at the depth of a mile by reason of development done on neighboring property, and that the Tonopah operators based their work and hopes on what had been accomplished by the more fortunate Tonopah Mining Co. on whose ground occurred, with but one or two exceptions, the only croppings of ore in the camp.

This is true in a measure, but in addition to the information gained by previous work, the Tamarack and Tonopah operators were actuated by a belief or hope of success that is almost as important as the technical ability to interpret those signs they had access to in neighboring development.

To be perfectly just we will admit that the failures far outnumber the successes, in a ratio that is not pleasant to contemplate. But even here we can get some comfort by admitting, as we must, that all these failures are not due to a lack of merit in the properties. Mismanagement, inaccessibility, market conditions, all three temporary and possible of rectification, have caused their share of shutdowns.

Up to this point we have established, I think, two reasons why capital hesitates to tackle the prospect. First, its demand for a comparatively low risk and high returns immediately eliminates any property not more or less developed. Second, its lack of a proper amount of willingness to "take a chance" bars it from the pioneer stage of mining, which is, ultimately, the one yielding the greatest returns for the smallest expenditure.

In a way capital has some excuse for its attitude of hesitancy, since in the past it has been severely handled by the fakers of the mining profession. Highly trained men who have not only the ability to advise, but the integrity to advise honestly are as plentiful in mining as in other engineering branches. They should be the tools with which capital attempts to make successful ventures.

It is to be regretted that more of the successful operating companies approaching the exhaustion of their present resources do not include in their efforts to obtain new holdings the plan of opening up prospects that appear to have merit. The value of many such properties could be proved or disproved with the money spent in the search for a developed mine.

The finding of the latter seems to be almost hopeless. This is to be expected, for there are but few conditions that would throw such a property on the market. Moreover, the purchase price is usually high for the reason that those features of the developed mine which make it attractive to the prospective buyer, are also assets to the owner. Should the price be moderate or low, having regard for the gross value of the ore developed, it may safely be argued that some condition exists, either as regards the cost of operation of the mine or the treatment of the ore that will be as inimical to the buyer as to the present owner. There are exceptions to this but they are extremely few.

On the other hand, prospects as a general thing, are no longer held at the ridiculous figures they have been in the past. Their owners, usually men of little financial strength, will normally make great concessions in order to have their ground developed. Money down is no longer demanded as it was. A few hundred dollars at the most to tide the prospector over a lean season, and capital can usually gain an option. The final purchase price is usually small when compared to the returns the ground will make if it proves to be the locus of a mine. As a general thing payments on the property may be so strung out as to give those taking the option ample time to form their own conclusion as to the desirability of going through with the deal before they have paid much more than their operating expenses. The net result is that capital would be doing some actual work with the money it is spending. It is "taking a chance" on finding a mine and should it be found, the price it would have to pay would not be much more than the interest on the sum it would have to expend for a developed property, should it be fortunate enough to discover one on the market.

Mining is crtainly a business. As much so as any other that contemplates the making of a profit by the sale or exchange of products. Business methods are as applicable in this profession as in any other. But conditions inherent in mining would warrant a different attitude toward it from that necessary in most others. Without the willingness to risk a comparatively small sum many times in the hope of developing a mine worth many times the aggregate of these small sums, it would seem that capital is bound to overlook some good investments.

JOHN M. FOX.

Tonopah, Nev., Sept. 2, 1913.

Measurement of Crushing Efficiency

In the issue of the JOURNAL for Sept. 27, you print under the above caption a letter from Algernon Del Mar, suggesting that mine or mill managers send to the JOURNAL data on crushing operations. I would suggest that the screen analyses be given on the basis of aperture sizes rather than ordinary meshes. I am convinced that the finer sizes are of great importance in making calculations of efficiencies, and only when they are given accurately can they help us to determine what is going on

in the minus 200-mesh material. I have plotted a good many crushing-surface diagrams from data given in the technical press and elsewhere within the last three years, but I am not sure of their comparative value for the reason that I cannot readily determine the reciprocals of the diameters.

I am of the opinion that the solution of the problem of the proper basis of crushing efficiency is for the laboratory, and that the crushing constants of the rocks experimented upon will have a great deal to do with calculated efficiencies of machines. The determination of crushing constants of rocks is not an easy matter, I am finding out. While I can show an enormous discrepancy between the number of Stadler's Energy Units per foot-pound applied for coarse and fine crushing, yet values of 30 to 90 mesh-grams per foot-pound (my unit if you please) are not very convincing, even when I explain that the difference all comes in the minus 200-mesh products.

A. O. GATES.

Purdue University, LaFayette, Ind., Sept. 29, 1913.

Experience with Storage-Battery Haulage Underground

The publication of an article on internal-combustion mine locomotives in the JOURNAL, Aug. 23, 1913, renders of interest the following letter descriptive of another method of underground haulage. The storage battery motor seems destined to fill a certain field satisfactorily. Or it may be that a combination storage-battery and trolley locomotive may be the efficient survivor.—EDITOR.

Our experience of less than one year with a storage-battery motor, does not enable us to state even approximately what the wear and tear and depreciation of these locomotives is going to be. Any excessive cost from this source will be because of deterioration in the batteries themselves. There are no indications that these will be short lived or wear out rapidly, since with the low voltage used, the commutators, brushes and rotors give less trouble than on the trolley system, where 500 volts is universally the practice. Also on this account there is less delay because of repairs. It is seldom that any of the storage-battery locomotives are reported in bad order and consequently there is no time lost, most of the adjustments are made at regular inspection intervals without a shut-down in the middle of the shift, as often happens because of commutator, brush or other troubles with the trolley locomotive.

The chief consideration in installing storage-battery locomotives here was that of safety. The menace of overhead trolley wires, dangerous no matter how closely boxed in, is by this means entirely removed. The storage-battery locomotive is most available for work on the sill floors of stopes, where the tracks are more or less crooked, switches are frequent and there are many chutes and manways to pass. Whenever there are any changes or repairs to be made in tracks, chutes, manways or timbering, the first requirement, when the trolley system is used, is an electrician to shift trolley wires out of the way.

The loss of time coming in and going back out of the mine to do this job and the general inconvenience of the whole matter make it costly. In running drifts, it is impossible to keep the trolley wire up to within several hundred feed of the face, because of the danger of a blast. Storage-battery locomotives can follow up to the face just as fast as the track is laid. No bonding is required, thus avoiding the first cost and troublesome attendance necessary to keep the bonds in repair and preserve a good conductor. In this connection the danger of electrolysis, from the return trolley current getting into the mine pumps and water pipes and possibly into power-house machinery, is avoided. The locomotive runners prefer them greatly to the trolley locomotives. Aside from their being so much safer they have no clumsy trolley pole to manipulate and their operation is "softer"; the weight of the battery gives a good tractive effort and by the use of intelligence and judgment no trouble is had in handling the batteries, and in keeping them charged up to full working conditions.

For haulage in our main tunnel level, where maximum trips are about 14,000 ft. each way, we are still using the trolley system, and will continue to do so. For all other work and for hauls up to say 2500 ft., storage-battery locomotives will be used. A motor-generator set placed underground operates on a 2300-volt. alternating current, and delivers from its generator a 110-volt. direct current for the batteries. This set is placed at the underground hoist and is stopped and started by the hoisting engineer at the telephoned request of the different operators, whenever current is needed for charging purposes.

STANLEY A. EASTON, Manager,
Bunker Hill & Sullivan Mining & Concentrating Co.
Kellogg, Idaho, Oct. 7, 1913.

No Malaria in Johannesburg

In an editorial in the JOURNAL of Nov. 1, entitled "Colonel Gorgas at Johannesburg," I note the following: "Although at an elevation of 6000 ft. above sea level, Johannesburg has been the center of one of the world's most renowned malarial districts. But of almost as evil reputation is the prevalence of pulmonary diseases," etc. As a one-time resident on the Witwatersrand, I should like to remark that malaria is unknown in Johannesburg and over the entire land.

From the time the early Dutch settlers came into the country down to the present, malaria has never been heard of, unless we cite those cases of individuals with fever in their system leaving the low veldt and becoming residents in or around Johannesburg, part of the high veldt land of the Transvaal. Malaria is only common in the low-lying districts of the country. The only real malarial districts of the Transvaal are to be far north along the Limpopo or Crocodile River, and east along the Portugese East African boundary. Mosquitoes are common during the summer months around Johannesburg, but the "fever carrier" is unknown.

The climatic conditions of the Rand are as good as any in the world. Men living in close proximity to mine dumps, the injurious effects of dust and the question of underground workers and pulmonary disease is quite a different matter and is of the most vital importance to the welfare of both white and colored workers and consequently to the mining industry of the country.

R. KNOX PATON.

Copper Cliff, Ontario, Nov. 5, 1913.

EDITORIALS

Blister Copper in Transit

The quarterly reports of the porphyry copper companies afford some interesting information, respecting the quantity of crude copper that is normally carried by such producers. In recent months they have had to carry but little or no refined copper. In some cases the companies say specifically that they were carrying no copper in that form. The smallness of the aggregate stock of electrolytic copper removes any doubts respecting the position of the porphyry companies in that respect. Consequently, it may be assumed that about all of the stock reported by them was in the form of concentrates or blister copper, the latter either at the smeltery, in transit, or at the refinery.

The aggregate stock reported by the Chino, Nevada, Ray and Utah companies, at the end of the third quarter of 1913, was 88,213,000 lb., compared to 87,414,000 lb. at the end of the second quarter. The slight increase in the third quarter was too small to be of any significance.

We do not understand why Nevada Consolidated should be carrying so much copper. At the end of each quarter it had on hand about 22,000,000 lb., which is just four times its average monthly production of 5,500,000 lb. Excluding Nevada Consolidated, the other three companies had on hand at the end of each quarter a little over 60,000,000 lb., or about three times their average monthly production. In other words, these companies have on hand normally about three months' production of copper. This gives an idea of the extent to which a Western copper producing company must provide itself with working capital. A company producing 1,000,000 lb. of copper per month at a cost of 10c. per lb., must have $300,000 to start in with, or else will have to borrow money against its shipments, which comes to the same thing in so far as cost is concerned.

Secretary Wilson on the Profits of Mining

Secretary of Labor William B. Wilson, addressing the American Federation of Labor at Seattle, Wash., on Nov. 12, strongly condemned the attitude of Michigan copper mining companies and warned them that a new conception of titles to property was in process of formation. He declared he would make public not only the wages paid to the miners, the hours they worked, and the labor conditions, but also the enormous profits of the mine owners.

Mr. Wilson, who addressed the delegates as "Fellow Unionists," remarked, moreover, that heretofore it had been the custom of the Department of Labor to investigate only wages, hours, and conditions of labor, and report. This time, he said, it had been determined to go a step further and investigate the earnings of the corporations involved. Then he added:

> And the little bit of confidence that I am going to give to you, is an advance statement of one of the items in that situation—that the largest corporation engaged in the production of copper in the Michigan district was organized in 1870 under the laws of the State of Michigan; that the face value of its capital stock is $2,500,000. The shares are $25 each. They were purchased at $12 each, so that the actual investment is $1,250,000.
>
> From that time until one year ago, the last fiscal report that we had—a period of 42 years—that corporation declared in dividends $121,000,000, and made reinvestments out of its earnings of $25,000,000. Nearly $200,000,000 of actual net profits in a period of 42 years on an investment of $1,250,000, and then not only protest against meeting committees of their workmen, but refuse to accept the good offices of the Department of Labor in negotiating the difficulty.
>
> They say their property is their own; that they have the right to do with it as they please. Maybe they have, but those who take that position have a false conception of the titles to property.

The Secretary said every title was law-created and law-protected, and that, deprived of those laws, the property involved would be at the mercy of the first strong and cunning man who desired it; and then talked some more piffle.

According to the newspaper dispatches, Secretary Wilson's audience was astounded by the nature of his disclosures. We do not wonder. We, also, are astounded.

The figures of the production of the Calumet & Hecla mines, and the amount of money originally invested in those mines, have been well known to everybody acquainted with the mining industry. A committee of the Copper Country Commercial Club recently investigated the conditions of the employment of labor in the copper mines of Michigan, and reported its findings, which have been published. This report went fully into the profits and losses of the mines, the wages paid to the miners, and many other details. Secretary Wilson cannot have anything to tell about those things that is not already known by the reading public. When, therefore, he threatens to make "disclosures" he is simply talking buncombe.

Something over 70 mining companies had operated in the Lake Superior copper region from 1849 to 1910. Of the entire list, only 14 mines have paid back the money invested in them. The dividends paid by all mines up to the end of 1910 were about $194,000,000; the assessments levied were about $79,500,000. The Calumet & Hecla company alone paid $112,500,000 in dividends. If that company be taken from the list, the remainder of the mines have just about paid back the money invested in them.

However, this has not much to do with the case anyway. The Calumet & Hecla was one of the phenomenal mines in the history of the world. It yielded to its developers great fortunes, just as did the Big Bonanza of the Comstock Lode. Their developers took long chances and were lucky. They were the exceptional favorites of fortune. The great majority of those who take long chances lose their money. Out of the host of adventurers in mines to few is it given to be successful.

The Calumet & Hecla mines have passed their zenith. The life of the company now depends upon the mining of low-grade ore, and from great depths. This can be done only by reducing the cost of production. It has not been

attempted to do that by reducing wages, but rather by the introduction of improved methods of mining, improved tools, etc. The matter of wages is determined by economic conditions. If an employer is unwilling to pay the market price for labor, he will not get the supply of it that he needs.

The cost of producing copper in Michigan is, on the whole, higher than the cost in Arizona and some other great mining regions. The Calumet & Hecla company is still able to pay large dividends, inasmuch as its ore still continues to be relatively rich as ore goes in the Lake Superior region, but other mining companies in that region do not find it easy sailing.

If a mining company is to be pronounced by the U. S. Department of Labor to be an enemy of society because it pays large dividends, and if it be a crime to risk money and discover a bonanza, then the outlook for the mining industry is bad. Such remarks as those of Secretary Wilson, phrased to inflame ignorant persons and to excite reckless passions are nothing short of scandalous in coming from a responsible cabinet minister. Most persons will agree with Mr. McNaughton in his remark that the good judgment of the companies in declining Hon. Mr. Wilson's services as mediator must now be apparent. If the report of our Washington correspondent be correct, viz., that Secretary Wilson's statements have passed in Washington without either apology or repudiation, and that he is in fact regarded as expounding the policy of the Administration, there is indeed ground for alarm.

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Modern Roasting Furnaces

In the metallurgy of copper, out of the long list of roasting furnaces of the past, the McDougal type has emerged triumphant, and nowadays scarcely anything else is to be found in use in American works. The usage is further limited to three varieties of this type, viz., the Evans-Klepetko, the new Herreshoff and the Wedge. Referring to recent installations: The Hayden works was equipped with Evans-Klepetko, the new Calumet & Arizona and Clifton works with Herreshoff, and the El Paso works (remodeled) with Wedge furnaces. The new plant of the United Verde Copper Co. is also to have Wedge furnaces. Thus all three have found representation in smelting plants of the first magnitude and of about contemporaneous erection.

In the metallurgy of lead the Dwight-Lloyd sinterer now stands preëminent, but the Huntington-Heberlein pots still find extensive use, and in certain particulars they are considered by some metallurgists still to have advantages. The introduction of blast roasting into the metallurgy of lead, as represented by these two exponents of the process, was one of the greatest developments of all time in the history of that art. A new feature in the metallurgy of lead has been the successful use of the Wedge furnace, at Herculaneum, Mo., and at Midvale, Utah, for the roasting of lead matte, a feat that heretofore has been troublesome to accomplish with a mechanically raked furnace.

In the metallurgy of zinc, the Hegeler furnace is the only thing in the modern plants. This furnace dates back to about 1882, since when it has been improved in dimensions and in details, but not otherwise to any very important extent. The survival of this old furnace, which is only semi-mechanical, indicates poverty of invention, or slothfulness in experimentation, or both.

In the sulphuric-acid industry, and for miscellaneous roasting, the Herreshoff and Wedge furnaces are commonly employed. Wedge furnaces are now being installed in two places for the sulphating of zinkiferous sulphides. Also it has been tried with favorable results in the roasting of low-grade copper ore preliminary to leaching. The Evans-Klepetko furnace also has been used for similar purposes.

Each of these furnaces has its particular points of merit. One or the other of them is to be found in nearly every large smelting works, and nowadays scarcely anything else is to be found except here and there something that survives as a relic of the past.

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Enriching the Blast

We have frequently referred to the excellent work done by James Gayley in his experiments on drying the air used in blast furnaces. The advantages of this process, although clearly demonstrated, have not received the attention which they deserve, and the process has not been adopted in this country to as great an extent as might be expected, while abroad it met with some active opposition. One large company, however, not only adopted the process, but has been conducting some interesting experiments in the addition of oxygen to the blast, thereby enriching it before its introduction into the furnace.

These experiments have been made by Ougree-Marihaye Co., at its furnaces in Belgium, one of the stacks being used for that purpose. Speaking very briefly, the process consists in supplying to the dried air an addition of oxygen, raising the proportion of oxygen in the blast from 20.8, the ordinary content of the air, to somewhat over 23%. The oxygen was obtained by liquifying the air, allowing the nitrogen and other more volatile gases to pass off, and finally compressing the oxygen into holders, from which it was fed, as desired. The process, as described by Gustave Transenster at the Brussels meeting of the Iron & Steel Institute, is not a very difficult or costly one, and the results obtained in increasing the product of the furnace with a smaller consumption of fuel was so encouraging that it is proposed to continue the experiments on a larger scale and it is even suggested that a blast composed of almost pure oxygen may be obtained. There is little doubt that this development of the Gayley process is a promising one.

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We are often asked by our readers to give the quotation for some metal during a current week. This we are unable to do. Although we report the daily market in the cases of the important metals, we canvass the market but once a week, at which time we review the transactions of the five days of business previous. The labor and attention that is involved by our methods do not permit of anything more frequent, the only exception that we make being when a month terminates in the early part of our week. Our week ends on Wednesday, on which day we go to press. The paper is out on the Friday following and is dated Saturday. In view of this delay, which results from our system of printing, we are glad to communicate our market quotations in advance to those who ask for them.

BY THE WAY

We find that an article on the Nosciniscato placers, Peru, which appeared in the JOURNAL of Oct. 18, 1913, with credit to the *West Coast Leader* as the original authority, was in fact first published in the *Mining and Scientific Press,* as to which no indication was given by the *West Coast Leader.* It is important in the interest of accuracy that the real source of data be always established.

⁂

According to newspaper reports, the Minerals Separation Co. wants $1.25 per ton royalty from the Butte & Superior company, for use of the oil-flotation process, in which use it is claimed that the Butte & Superior is infringing the Minerals Separation patents, although the Butte & Superior company denies that it is infringing. Apparently the case between Minerals Separation and James M. Hyde was only a preliminary skirmish, and the real fight is to come in the trial of the present case. Judge Bourquin, on Nov. 14, decided against the Butte & Superior company, but refused to enjoin it from use of the process, considering that the higher court might reverse his decision On the 5th of each month the Butte & Superior is required to file a complete statement of its output.

⁂

The Eastman Kodak Co. says that it is the largest consumer of silver bullion in the United States, and moreover that it purchases more than any concern other than the U. S. Mint. The Eastman company manufactures its own silver nitrate and uses from six to seven tons of silver per month. This is a lot of silver and the producers thereof are duly grateful for such an absorption of their commodity. However, we should imagine that some of the silversmiths or silver-platers might be even larger consumers than the Kodak company.

⁂

Francis E. Nipher, professor of physics at Washington University, has discovered what he says is a new law in physics, which he thinks is likely to lead to great changes in the principles of construction of power machinery, says the New York *Sun.* The alleged discovery is that on an incline of from 45 to 60° more power is required to propel an object on the surface than would be required to lift it outright. The explanation is that at an incline between the degrees mentioned the frictional resistance makes the load heavier than its dead weight. Recalling the velocity with which our dead weight alone has propelled us down 45° pine boards, we feel confident that there was a mixup in transmission.

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Referring to Secretary Wilson's speech in Seattle, Mr. McNaughton, general manager of the Calumet & Hecla company, is quoted as saying: "Mr. Wilson, through representatives of his department, made a thorough investigation of strike conditions. Upward of 20 of the mining companies answered a series of 110 questions each. Mr. Wilson's criticism of the mines of this district is based on the reply of one company to two of these questions, those pertaining to capitalization and to dividends. Evidently, Mr. Wilson could find no fault with the answer to the other 108 questions asked the Calumet & Hecla Mining Co., or to the 110 questions asked each of the other companies. He selected for the purpose of his confidential advance statement, answers to two questions which had no bearing whatever on the controversy."

⁂

The remarkable effect of a carnotite deposit on the men working on it is thus described by the Salt Lake *Tribune.* "One peculiar effect of the presence of uranium oxide is observed in the men who work on the ground. The very air appears to be radio-active to a great degree. No man working on the ground has been known to have had rheumatism, even though he had been previously subject to it in greater or less degree. The ore and atmosphere combined seem also to have a beneficial effect on the stomach and associated organs. Evidently there is so much of radio-active content in the sandstone and petrified streak that its force is projected above the surface. The effect has been noted by all the men who have worked on the ground." It will not be long before the quacks are advertising "bottled carnotite," or something equally good.

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At the 12th Allegemeine Deutsche Bergmannstag (concluded Sept. 5, 1913), Dr. Leinbach, of Göttingen, read a paper on electrical ore finding, with special reference to the principles established by Dr. H. Löwy. Even in the embryonic condition of this new science, the author points out, the results of boring operations and of general geological exploration can be usefully supplemented by the electro-dynamic methods at present recognized by scientists, and many other spheres of utility are open to them. Much, however, remains to be done in order to fulfill the expectations placed in some quarters on those methods. In this connection it is interesting to hear that the mining authorities in German South-West Africa are at present employing the method, experimentally as well as in practical work, for the discovery of minerals and water in the protectorate. The importance attached in Germany to the question of the divining rod is evidenced by the fact that a very influential association has been formed there for its elucidation, says the *Mining Journal.* The first general meeting of this association took place on Sept. 18 to 20 last at Halle, in Prussian Saxony. One hundred and twenty members from all parts of Germany and a few foreigners were present, among them the president of the province, two prominent professors of the University of Halle, Professor Dr. Krusch, the well known geological expert, as representative of the Prussian geological department, and delegates of several influential scientific associations. About 20 professional divining-rod men, half of them qualified boring engineers and well sinkers, were also present. Five special commissions of members of the association had been appointed for the purpose of examining and testing the execution of special tasks set to certain divining-rod performers, among them the determination of some subterranean cavities, of brown-coal deposits, and of water conduits containing partly ground water, partly filtered river water, and partly brine —all in the vicinity of Halle. However, the time at the disposal of the commissions proved too short for obtaining definite results, and a permanent local committee was appointed for concluding the work initiated by the commissions. These Germans certainly do take it seriously.

PERSONALS

Corey C. Brayton has returned from Nome, Alaska, to San Francisco. He was engaged during the summer in gold dredging in the Solomon district.

George A. Packard intends to make his Boston office, 50 Congress St., his headquarters for a time rather than at Butte, Mont., as in the recent past.

Newton W. Pilger, of Butte, Mont., is now superintendent at the Iron Mask mine, near Kamloops, B. C. The property is owned by a Duluth, Minn., company.

Sir Alfred Mond recently inspected the nickel mines at Sudbury, Ont., and established a new town at Coniston, where the works of the Mond Nickel Co. are.

E. H. Nutter, of San Francisco, chief engineer for the Minerals Separation American Syndicate, Ltd., was in Slocan district, British Columbia, at the end of October.

Lawrence Addicks, Percy E. Barbour, Samuel J. Gormley and Ralph B. Williams have been elected to membership in the Mining and Metallurgical Society of America.

I. L. Merrill, president of the Hedley Gold Mining Co., recently visited that company's Nickel Plate group and 40-stamp mill in Similkameen district, British Columbia.

L. D. Davenport has resigned his position at the Ernestine mine, in the Mogollons, New Mexico, and is again connected with the Oliver Iron Mining Co., at Eveleth, Minnesota.

J. V. N. Dorr will spend a great deal of his time in New York this winter attending to the business of the Dorr Cyanide Machinery Co., which has opened an office at 50 Church St.

W. E. Finch has returned to Spokane, Wash., for the winter. He is manager for a syndicate engaged in development, under option of purchase, of mining properties in Slocan district, British Columbia.

Wilber D. Greenough, manager for the Atlas Mining Co., has returned to Whitehorse copper camp, southern Yukon, after having spent a month at Spokane and other parts of the northwest states.

L. F. S. Holland has returned to Telluride, Colo., after examining mines in Beaver County, Utah, and Park County, Colo. He is arranging to make his headquarters in Los Angeles, Calif., during the coming winter.

Howard W. DuBois was in Victoria last month, after having spent some time investigating mineral resources in the eastern part of the Caribou district of British Columbia, and thence over the Rocky Mountains in Alberta.

W. M. Brewer has returned to Victoria, B. C., after having traveled more than 1000 miles on horseback investigating conditions in several mining districts of British Columbia to report on same to the Provincial Department of Mines.

H. W. Hardinge is at present on an extended tour through the Northwest, including British Columbia, to inspect recent large installations of Hardinge mills in that district. Mr. Hardinge expects to be gone between six and eight weeks.

Andrew Clark, superintendent of the openhearth department of the Carnegie Steel Co., at Farrell, Penn., has resigned and Ford Corill will succeed him. L. M. Tittsler has been appointed superintendent of the openhearth department at the company's Sharon works.

Otto Wartenweiler has left Pearce, Ariz., where he had charge of the mechanical design and construction of the milling and cyanide plant of the Commonwealth Mining and Milling Co., and has opened an office in Los Angeles as manager for Otto Wartenweiler & Co., engineers and contractors.

George F. Waddell, superintendent of the concentrating mill of the Nevada Consolidated Copper Co., at McGill, Nev., has resigned that position in order to become manager of the Ohio Copper Co., in Utah. Albert Frank, who retires from the management of the Ohio Copper Co., will continue to act as its consulting engineer.

S. S. Sörensen, who has been in charge of the reduction works of the Nevada Consolidated Copper Co., at McGill, Nev., since that plant went into operation, previous to which time he was its chief engineer of construction, has retired from that position in order to become general manager of the Braden Copper Co., in Chile. R. T. White, former manager at Braden, is now on his way home to the United States. Mr. Sörensen's successor at the Steptoe Valley works has not yet been appointed.

OBITUARY

Mrs. Alexander E. Hamilton, mother of F. McN. Hamilton, state mineralogist of California, died suddenly of heart failure at San Francisco, on Nov. 3. Mr. Hamilton was returning from a professional visit to the oil fields and other mining districts in southern California at the time, and could not be informed of the death of his mother until he reached San Francisco. Mrs. Hamilton was 67 years old, born in New Brunswick, and with her husband, now deceased, went to California in 1868.

John W. Cox, a pioneer California miner, killed himself at Forbestown, Butte County, Calif., on Nov. 8. Cox went to California across the plains in 1849. He killed himself with the gun he had carried for protection from Indians, a muzzle-loading rifle. He had been a resident of Forbestown since the days of rich placer mining in that district. Recently he had been ill with dropsy and relatives wished to place him in a sanitarium, but he preferred death at his own hands to leaving the cabin he had occupied as home for 25 years.

SOCIETIES

Mining & Metallurgical Society—The New York section met on Tuesday, Nov. 18. About 25 members were present. The subject of discussion was the flotation process of ore separation, in which there was general participation.

Society of Chemical Industry—The regular meeting of the New York Section was to be held Nov. 21. The program for the evening included papers on: "The Corrosion of Metals and Alloys in Contact," by Richard H. Gaines; "The Relation of Composition of Ash in Coal to its Fusion Temperature," by Oscar W. Palmenberg; "A Peculiar Dust Explosion," by William M. Grosvenor.

American Institute of Mining Engineers—The first regular meeting of the Colorado Section was held at the Brown Palace Hotel, Denver, on Friday, Nov. 7, at 7 p.m. After dinner had been served, a discussion was opened on "The Effect of Present Methods of Taxing Mines on the Mining Industry of Colorado." William J. Cox, chairman of the Colorado Section, presided at the meeting. The discussion was highly educational and brought out many interesting and important phases of mine taxation. Among the speakers were William J. Cox, W. V. Hodges, H. A. Webb, Thomas B. Stearns, Philip Argall, Richard A. Parker, E. N. Hawkins, Ernest Le Neve Foster, D. W. Brunton, Charles J. Moore and Mr. Hammond. Attention was called to the unjust burden of taxation borne by the mining industry, due to the comparatively low valuation placed upon real estate and industries other than mining, which by unjustly reducing the proportion of the taxes paid by these industries caused a corresponding unfair increase in the taxes on mining property. The question of taxation will be further discussed at a future meeting.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ORE TREATMENT—Process of Treating Ores Containing Silver. Erich Langguth, Neerpelt, Belgium. (U. S. No. 1,078,360; Nov. 11, 1913.)

GAS REMOVAL—Apparatus for Treating Molten Metals, Alloys, and Steel. Louis Marie Victor Hippolyte Baraduc-Muller, Paris, France. (U. S. No. 1,077,925; Nov. 4, 1913.)

IRON-ORE TREATMENT—Process for the Extraction of Gold and Silver Remaining in Iron Ores which Have Already Been Treated for the Removal of Sulphur, Copper or Other Metals. H. M. Leslie, Glasgow, Scotland. (Brit. No. 22,909 of 1912.)

OPENHEARTH FURNACES—Improvements in or Relating to Regenerative Openhearth Furnaces for Metallurgical Purposes. Kurt Albert, Amoneburg, Germany. (Brit. No. 28,960 of 1912.)

LEAD REFINING—Apparatus for Refining Lead. Joseph Franklin Beattie, Hammond, Ind. (U. S. No. 1,078,408; Nov. 11, 1913.)

MANGANESE—Method of Extracting Manganese from Its Ores. Friedrich Heusler, Dillenburg, Germany. (U. S. No. 1,078,199; Nov. 11, 1913.)

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—Nov. 12

An Early November Rainfall extended throughout the northern part of California, continuing intermittently for several days from Nov. 1. Precipitation in the mining districts was general and of great value in providing water for hydraulic mining and for milling in the drier counties. The dry season has been longer this year than usual and a large number of the smaller mines were compelled to shut down late in the summer, especially those that use water for power.

Purchases of State Highway Bonds to the extent of $50,000 are to be made by the Siskiyou County supervisors in accordance with an agreement with the state highway commission to route the Siskiyou County portion of the highway through the town of Yreka, the county seat, instead of through Montague. The two Yreka banks have agreed to purchase a like amount of these bonds. Siskiyou is the first county north of Sacramento to make liberal subscriptions to the bond issue.

An International Engineering Congress is to be arranged for by the Panama Pacific International Exposition at San Francisco. The week beginning Sept. 20, 1915, has been tentatively set apart for the session. It is understood that Col. George W. Goethals, chief engineer of the Panama Canal Commission, has consented to act as honorary president of the congress, which will be held under the auspices of the American Institute of Mining Engineers and other engineering societies.

DENVER—Nov. 15

Strike Situation Is Worse, for on Nov. 7 three mine guards and their automobile driver were ambushed and killed by seven strikers near La Veta. Charles Richards, vice-president of the La Veta union, is said to have been the ringleader. The murderers have been captured by the militia and have confessed. It was then found that the force of militia is entirely inadequate to maintain order and restrain violence over the wide area affected by the strike, and Governor Ammons threatened to call for United States troops from Fort Douglas. Later it was published that no Federal aid was available within 1000 miles, and then the agitators grew bolder. The Delagua mines were attacked the night of Nov. 10 and many shots were fired. The Baldwin mines in Gunnison County, owned by the Rocky Mountain Fuel Co., were closed and 50 miners walked out. The Leyden miners will also go out and are erecting tents for the colony of strikers. What has more than all accentuated the situation and emboldened the strikers is the fact that State Auditor Kenehan has refused to issue certificates to pay the militia. At midnight Nov. 10 the Hecla mine at Louisville in the northern field was attacked by strikers and 300 shots were fired, the boarding house and cottages being riddled by bullets, the miners and their families hiding in cellars and behind coal cars and concrete ashpits until the mine guards could be gathered, when the shooting stopped. There is now fear of a series of outbreaks in the northern fields similar to those in the south. Governor Ammons in an informal statement, Nov. 11, is said to have declared that the blame for prolonging the strike is due to Auditor Kenehan's assurance to strike leaders that he would refuse to allow the state to advance money to send troops to the strike fields. Otherwise the strikers would have compromised Oct. 26 and peace would have been assured. The operators have practically conceded everything asked for, except recognition of the union; they will take back any of the strikers except those convicted of lawlessness, but they adhere to the open-shop policy and right to employ non-union men. The heads of the Colorado Fuel & Iron Co., the Victor American, Fruth and Autrey companies, also offer to give a coal mine to the city or state for the cost of the equipment in order to enable the government mining theory to be tested. The governor appealed to the patriotism of the business men to carry militia accounts until the courts could mandamus the state auditor. This was accomplished Nov. 13, the supreme court issuing an alternative writ of mandamus against Auditor Kenehan and his deputy, Nelson Ballou, ordering them, or one of them, to appear in court Nov. 14 and show cause why they should not be compelled to issue certificates of indebtedness for the expense of maintaining the militia in the coal-strike district. On the same day a meeting of state editors was held at the Brown Palace Hotel to hear the basic causes of the strike, so that they might be able to tell the public the whole truth of the matter. The governor and about 60 men were present, representing organizations of members of nearly every industry and profession in the state. The mine operators, mine owners and miners were equally prominent at the conference. All sat side by side as they listened to the story of the strike from the lips of the chief executive and the men who are parties to it. The United Mine Workers have a paid advertisement in the papers of which the heading is as follows: "All the miners ask is a living wage and the enforcement of the state laws." A living wage they certainly get, as evidenced by the following which the operators publish from the company payrolls: "The average wage at the Rouse mine in August was $4.41 per day, at the Bowen mine, $4.27; at the Primero mine for October $4.98; at the Sopris mine for October $4.67; and at the Gray Creek Mine for October $4.90. As to the state laws, the operators have signed an agreement with the governor to comply with these fully in every respect. At a meeting of a committee of the chamber of commerce a resolution was passed as follows: "In our opinion conditions at the mines did not justify the present strike and the campaign of terrorism inaugurated by the strikers was for the sole purpose of preventing the miners, through fear, from returning to work. Without the bloodshed and lawlessness that has prevailed a majority of the men would probably have returned to work and we have reason to believe that with assured protection for the miners operations will be quickly resumed." This is the situation up to date.

BUTTE—Nov. 12

The "Smoke Lawsuit," which was instituted by Montana farmers to get relief from the fumes from the Anaconda company's reduction works was dismissed Nov. 14, by the supreme court of the United States. The suit has been pending for more than five years and has been a disturbing factor to thousands of people. A granting of the plaintiff's demand would have involved the suspension of important mining activities in Butte, the closing of the Washoe works at Anaconda and the crippling of many other dependent industries in Butte and Anaconda. The announcement that the supreme court has put an end to the old lawsuit came as welcome news to the residents of the entire state of Montana.

The Minerals Separation Case against the Butte & Superior company is in the hands of the judge of the Federal court. During the days of the hearing experts were present from New York and Chicago and there were practical demonstrations in the court room of the working of the process in use at the Butte & Superior mill, witnessed by many prominent mining men. One of the arguments put forward by the Minerals Separation company was to the effect that in consequence of the use of the process by the Butte & Superior company it was prevented from closing deals for the sale of the patent to other mining companies and that others have even refused to treat with them and have broken off possible deals altogether and they have suffered great financial losses. The demonstrations were made by Frank Janney, of Salt Lake City. Judge Bourquin did not take much stock in the affidavits submitted and plainly told the attorneys so, remarking that he wished to observe the actual working of the system rather than consider information gained from statements contained in affidavits. O. Wiser, a chemist of the Ray Consolidated mill, at Hayden, Ariz., assisted in a number of experiments and told of the methods used in getting exhaustive data on the subject of oil agitation. [Judge Bourquin on Nov. 14 rendered a decision in favor of the Minerals Separation Co. —Editor.]

SALT LAKE CITY—Nov. 13

An Enlarged Homestead Act, copies of which have been received by the U. S. Land Office of this city, names 7000 acres of Utah land which are to be opened to entry Nov. 20, 1913. Exception will be made for timbered and mineral lands.

Three Mines Paid Dividends amounting to $295,000 in October. These were the Daly-Judge, in Park City, with $45,000, the Iron Blossom, of Tintic, with $100,000, and the Utah Consolidated, of Bingham, with $150,000.

CALUMET—Nov. 15

Organization of the Citizens' Alliance and the withdrawal of practically all the remaining militia, excepting the local soldiers on duty, were the most important developments of the week with regard to the strike situation. The arrival of several hundred additional workingmen and the establishment of "cost" stores by the Western Federation of Miners likewise were incidents of some comment, as was the conviction of "Big Annie," a spectacular Amazon, who has been leading the early morning parades and posing for pictures with an American flag background for the use of the socialistic magazines engaged in so called uplift work and for newspapermen who found her a great subject for so called human-interest stories. Big Annie headed the strikers' parades, carrying a big flag. She broke a supreme court injunction every morning before breakfast and enjoyed it. She forgot to appear in circuit court when her trial was called and she was wanted as a witness in her own defense. She enjoyed the publicity and the pose. It was a kind of heroism business that was different from the boarding-house employment that kept Annie busy before the strike. Militant socialism was heaps of fun for Annie. But in the course of time, after Annie had been arrested half a dozen times, she was tried and the plain, business-like jury lost little time in finding Annie guilty of assault and battery. The complainant was a little miner, who insisted on going to work whether Annie and her American flag blocked the way or not. Then the Western Federation lawyers appealed the case to circuit court. There was another trial and the jury brought in a verdict of guilty. In face of the facts that Annie is a rather good-looking woman, that she assaulted a man, that there are other influences that frighten juries and witnesses, this conviction indicates a little something of the trend of the public mind in the copper country relative to the strike. The jury refused to make a heroine out of this assaulter. And the jury had plenty of time to consider the evidence. The formation of the Citizen's Alliance seems to be a spontaneous action to rid the community of the Western Federation of Miners. For 50 years this district got along without any serious labor trouble. Four months ago the Western Federation called a strike and disorder has prevailed ever since. The Alliance has one object in view. That is, the elimination of the Western Federation from the Michigan copper country. There is something of mystery about its formation and as far as can be learned it has no officials. Just what the total membership is likewise something of a quandary. It purposes, in addition to driving out the Western Federation, to give moral and physical backing, if necessary, to the men who are working.

DEADWOOD—Nov. 11

The Mine Inspector's Annual Report for the year ended Oct. 31, shows that during that period the bullion product of the Black Hills mines was $7,497,100, of which only $2000 came from placer mining; that there are 2960 men employed in the mines of the district; that there were during the year 9 fatal and 8 non-fatal accidents. In addition to the precious metal output, there was produced during the year mica worth $6950; gypsum products, $61,735; tungsten ore, $2000; lithia ore, $19,500; building stone, $106,000; coal, $12,000 and miscellaneous, $40,000, a total of $248,135. Following are the figures of bullion production and tonnage as given in the report: Homestake, $6,250,000, 1,533,000 tons; Golden Reward, $423,840, 53,712; Wasp No. 2, $286,930, 163,380; Trojan, $280,518, 68,106; Bismarck, $50,000, 31,980; New Reliance, $73,323, 27,100; Mogul, $44,117, 5593; Placer, estimated, $2000; Miscellaneous, $86,372, 10,600; Totals, $7,497,100, 1,893,471 tons.

Compliance with the New "Blue-Sky" Law which the legislature, of South Dakota enacted last winter, and which is now in force, has not been found an easy matter by those companies which have attempted it. The law, which is patterned after the famous Kansas statute, makes innumerable requirements, such as the furnishing the state securities commission, which is headed by the state bank examiner, with such information as a list of directors and officers, with their known financial worth, the amount of stock held by each, and the price or compensation paid by each, for his holdings; a complete list of stockholders of the corporation, with the price or compensation paid by each for his holdings; a copy of all contracts or agreements in force; a statement as to the work or business to be undertaken; a balance sheet of the corporation, etc. The usual course then seems to be, according to those who have attempted to secure permission to sell stock in the state, that the official in charge of the office requests the company making application to forward to him $50 to cover the costs of a visit to the property "to view the assets." Inasmuch as the man sent out knows practically nothing of mining, and not a great deal about business, this part of the law is regarded in the mining districts of the state as a huge joke. But finally the commission will issue authority to sell the lot of stock or bonds asked for, specifying the price at which it shall be sold, and it cannot be sold for any other price. If that allotment should be placed and a change of price decided upon by the directors or those in control of the company, permission to do so must be secured from the commission. It may be mentioned that this second permission is easier secured than the first.

VALDEZ—Nov. 7

The Kasna Creek Group of nine claims was sold three years ago by Schlabin, Brown & Walker to New York and Boston men and the purchasers are now patenting their ground. Kasna Creek flows into Konteshebna Lake and is 120 miles from Seward via Iliamna Lake. The claims are 3000 ft. above sea level. The ore occurs in altered limestone and dips at an angle of 80° and strikes north. It has a length of over 5000 ft. and a width of 500 to 1000 ft., broken by horses of garnet rock. Three tunnels have been driven in doing the work necessary to securing patents, an 80-ft. and a 50-ft. tunnel being in ore and a 120-ft. tunnel which was not driven in ore because of danger from snowslides. The ore is chalcopyrite associated with hematite and 50 samples show an average of 1.7% copper with a little gold. The rocks inclosing the ore are shales and quartzites, while granite, mica schist and volcanic tuffs are found in proximity to it. Small diorite dikes cross the ore. A smelter site has been secured at the mouth of Kasna Creek and also a site for a power plant eight miles distant at the outlet of Konteshebna Lake. The present owners propose to spend $200,000 or more in diamond drilling the property and if the results are satisfactory a railroad 120 miles in length will be built to give access to it. Machinery for drilling will be put on the ground next season. The district in which the Kasna Creek group is located presents some interesting geological features. There are no less than three extinct volcanoes near the property and facing on Konteshebna Lake.

SUDBURY, ONTARIO—Nov. 17

Mond Nickel Co. Purchased last week all the properties owned by Messrs. Stobie, Rinaldo McConnell and R. J. Tough, comprising three of the seven properties known as the Levack group, situated on the west side of the nickel belt. The three properties were sold for $550,000. During April of this year drilling operations were commenced on what is known as No. 1 property. Since then eight diamond drills have been in operation. It has been learned on good authority that between 3,000,000 and 4,000,000 tons of ore have been proved by diamond drills on No. 1 property alone, which is situated on lot seven, concession two, Levack Township. No. 2 property is situated on lot six, concession two, Levack Township, and is yet to be drilled. No. 3 property is situated on lot two, concession four, Levack Township. Lying between these properties are other lands containing valuable outcrops of nickel-copper ore and owned by men most of whom live in Sudbury. Canadian Pacific engineers are on the ground; a contract has been let for building a four-mile spur into the property from the main line of the Canadian Pacific Ry. at Old Onaping or what is to be known as Levack. This spur is to be finished in the shortest possible time. It is anticipated that ore will be shipped from the properties next March. Preparations are being made to carry on mining operations on what is known as No. 2 property, the ore on which can be taken out from open cuts. The ore on No. 1 property lies beneath a swamp or marsh and can be mined from a shaft only. Diamond drilling in Levack has disclosed new geological conditions which were not before known to exist on the nickel range and may have a marked effect on drilling operations for nickel ore.

TORONTO— Nov. 17

A Sample of Calgary Oil has been received by the Canadian Geological Survey. The oil came from the recently struck No. 1 well of the Calgary Petroleum Products Co. at Black Diamond, 16 miles west of Okotoks, Alta. This oil, which was struck at a depth of about 1560 ft., is what is technically known as a "white oil," being transparent and of an amber color. It is phenomenally light for a natural mineral oil, having a specific gravity of about 62 Baumé and evidently consists largely of gasoline. "White oils" are rarely found in quantity and appear to be the result of filtration through clay strata, under pressure of the lighter portions of ordinary petroleum. That this has occurred in the present instance is rendered probable by the fact that at a higher horizon in the well a flow of gas of 2,000,000 cu.ft. per day was struck. "White oils" are usually found only in the vicinity of large bodies of ordinary petroleum.

THE MINING NEWS

ALASKA

A RECENT STRIKE IN NELCHINA DISTRICT, 80 miles from Valdez, is causing much excitement. Reports state that bedrock is found at from 5 to 10 ft. Prospectors are going in.

CLIFF—Company is making preparations for extending tunnel to payshoot.

RAMSAY-RUTHERFORD (Valdez)—Company is planning to equip mine with stamps and other machinery.

ALASKA UNITED (Douglas)—In September, 19,054 tons of ore crushed in Ready Bullion mill yielded $45,737 or $2.42 per ton; profit $15,829. In 700 Claim mill, 18,060 tons yielded $43,649 or $2.44 per ton; profit $15,427.

ARIZONA

Cochise County

GOLD MINING & MILLING CO. (Cochise)—Syndicate of Denver men has taken lease on property. Large tonnage of $4 ore blocked out. Under terms of lease new operators are to build a mill of not less than 150 tons capacity before end of two years.

Gila County

INSPIRATION CONSOLIDATED (Globe)—Operating of the new test mill will probably begin Dec. 1. However, this depends greatly upon two things; electric power and water. An 8-in. pipe line has been laid from Wog's ranch to mill, but no water as yet has been turned on. Power is dependent upon Roosevelt-Miami-Superior transmission line, now in course of construction, and it is not certain that wires will be at Inspiration plant at required time. Mill will have a daily capacity of 600 tons and will contain two 20-in. conveyor belts, one automatic weighing machine, two 48-in. fine disk crushers, one 36-in. disk crusher, one 48-in. roller mill, four Hardinge mills, one of the mills being 10 ft. in diameter, the largest manufactured; four drag classifiers, three No. 6 Wilfley tables, two Deister multiple-deck tables, one No. 4 Deister table, two No. 2 Deister tables, two double-deck slimers and one improved slimer, two elevators and flotation equipment. Mill will be so constructed that method of treatment may be changed as often as desired with little trouble, purpose of mill being to test various methods of treating ores. Work is progressing rapidly at excavating for air compressors and transformer building and within few days concrete pouring will be in progress at that point. Crushing plant at Scorpion shaft has been completed and is ready for operation. American Bridge Co. has four gangs busy riveting ore bins. One span of conveyor housing between bins and coarse-crushing plant is now in place and 95-ft. boom on locomotive frame will be increased to 185 ft. Boom will have to be of that extreme length to erect headframes of Main East and West shafts, Main East being 185 ft. and Main West 165 ft. high. This will be the longest boom ever put on a crane by this company, next greatest being at Panama, which is 150 ft. long.

Maricopa County

MAX-DELTA (Phœnix)—Mine has resumed work. There is talk of building a mill later.

R. F. SCHAFER (Peoria)—A small mill may be built soon on gold claims near Vulture mine.

SUNFLOWER CINNABAR MINING CO. (Phœnix)—A four-ton pipe retort was recently installed and a flask of quicksilver was exhibited at state fair recently held at Phœnix. Shipments of quicksilver will be made from time to time.

Mohave County.

BOUNDARY CONE (Oatman)—Plans are being made for a mill.

PITTSBURGH (Gold Road)—The headframe on this property has been completed and sinking of the shaft is in progress. It is now over 50 ft. in depth.

DISTAFF (Chloride)—Lessees have installed a crushing plant at lower end of dump and are concentrating low-grade ores. Concrete high in zinc, carrying $200 in silver, is obtained.

LEXINGTON (Oatman)—At 200 ft. depth on Lexington vein, 24 ft. of ore has been opened through a crosscut; 8 ft. shows gold ore of good grade. Shaft on Big Johnny vein is to be equipped with new hoist and shaft sunk 100 ft. deeper; pumping 70,000 gal. daily.

COPPER GIANT (Hackberry)—One carload of ore per week is now being shipped to United Verde smelting plant. As soon as arrangements at mine for handling ore have been perfected and new siding is in commission shipments will be increased to one car per day.

Pinal County

CLIPPER (Kelvin)—Negotiations are underway for early resumption of work on shaft. Property was examined lately by Eastern engineers.

RAY-ARIZONA (Kelvin)—Second churn-drill hole has reached depth of over 400 ft. Preparations are being made to sink large working shaft.

KELVIN-SULTANA (Kelvin)—Two carloads of shaft timbers and auxiliary hoist have been received. Work on Westfall shaft will be commenced before end of month. Winze on No. 1 vein from 300-ft. level is being sunk in 6-ft. shoot of disseminated ore which carries 4% copper.

Yavapai County

CLARKDALE SMELTING WORKS is rapidly being completed, and track is being laid on spur which has been built from new works up to 7000-ft. tunnel, to connect smelter and mine with railroad. All operations with new smelter will be carried on through the 7000-ft. tunnel, which taps the United Verde mine on the 1000 level.

PITTSBURGH-JEROME (Jerome)—Mine is idle at present. It is not known when work will be resumed.

HAYNES COPPER CO. (Jerome)—Sinking continues. It is expected that 1200-ft. level will be reached by Dec. 1. Diamond drills will then be used.

FORTUNE (Poland)—Company has purchased mill on old Annie mine and will move it to Wizard claim of their property, where it will be overhauled and improved. Six months will be spent in developing lower levels by which time it is expected that mill will be ready for use.

CALUMET & JEROME (Jerome)—The long tunnel is nearly completed. It was driven in at depth of 500 ft. to cut ore under apex of mountain. Ore of good grade was found while sinking a shaft near apex. This shaft is 140 ft. deep. Tunnel is about 625 ft. long at present, and in last few feet heavy mineralization and a change in formation appear.

CALIFORNIA

ACCIDENT at Zelia mine, when a miner was injured by striking a pick into a missed hole, resulted fatally. Besides losing eyes miner's breast, face and arms were torn and he was injured internally, dying Oct. 16.

BUNKER HILL (Amador City)—Usual monthly dividend, 2½c. per share, was paid Oct. 15. Cleanup for October is reported to be much larger than for several months.

SOUTH EUREKA-ONEIDA (Sutter Creek)—October dividend, 7c. per share, has been disbursed, approximating total of $21,000, bringing total for 10 months of 1913 to $109,991. Both mills are running on good ore, South Eureka mill dropping 80 and Oneida 20 stamps. Connection between the two mines has been made.

Butte County

STEIFER MINING CO. (Magalia)—Reinforced-concrete dam across west branch of Feather River is completed. Work has been started on flume, one mile long, to connect power house to old dam. New dam is 10 ft. high, 8 ft. thick at the base and 4 ft. at crown. Situation necessitated lowering materials with gasoline hoist.

BUTTE CREEK CONSOLIDATED GOLD DREDGING CO. (Chico)—Judgment of $4000 has been awarded company against Laura F. Olney, of Washington D. C., who had failed to establish title to 20 acres of ground sold by her. Litigation stopped operation of company's dredge for some time. Dredge had been repaired and new bucket line installed a short time before litigation interfered.

Humboldt County

ORLEANS BAR DISTRICT, one of the early placer districts of state, is developing in lode mining. George Wilder and Antonio Lyons recently purchased the Portland, formerly known as Pioneer. A large amount of ore has been worked in arrastre, which will be displaced by a stamp mill if development warrants. The Hdnter on Ten Eyck Creek is reported to be in profitable operation. Ore is cyanided. Red Cap mine, which has attracted much attention recently, is said to be in profitable operation. Opening of wagon road from Eureka to Orleans has been of great benefit to mining in the district.

HORSE MOUNTAIN (Eureka)—A purchase option has been taken by E. B. Harper, of San Jose; 25 tons of ore was recently shipped to Tacoma.

CORONA DEL ORO (Eureka)—Concentrators are being installed to work sand tailings from hydraulic plant. It is reported that Englishmen have asked for option.

Kern County

NEW BORAX DEPOSITS 25 miles south of Randsburg near San Bernardino county line, are reported to have been recently purchased by F. M. ("Borax") Smith.

MAMMOTH CONSOLIDATED (Caliente)—It is reported that preparations are being made for driving 1100-ft. tunnel that will give a vertical depth of 700 ft. on Eureka vein. Installation of six-drill compressor and 70-hp. gasoline engine is contemplated.

Mariposa County

BOWER CAVE (Mariposa)—Property has been bonded to T. G. Mudgett, of San Francisco, and development has been started.

Nevada County

VICTORY MINES CO. (Grass Valley)—A new drain tunnel is being driven in Buckeye mine to be used for draining lower workings. Tunnel will be 350 ft. long and will tap vein. Thorough development is contemplated.

Plumas County

ROSE (Quincy)—New 5-stamp mill was put in commission first week in October.

CHANNEL PEAK (Quincy)—Work has been suspended for the season. Large flow of water was recently struck in tunnel, indicating proximity to channel.

Shasta County

UNION MINING & POWER CO. (Redding)—The dam on Clear Creek will be repaired.

GLADSTONE (French Gulch)—The retimbering of the shaft is about completed and the installation of the electric hoist will proceed immediately upon arrival at the mine. Two carloads of the machinery have been received at Redding, the nearest railroad station. The three other cars are expected soon. The hauling to the mine will be by teams. The new hoist will be one of the largest in California.

Siskiyou County

ELIZA (Yreka)—Erection of a reduction plant is contemplated. Development has been in progress for three years and much ore has been blocked out.

SHASTA VALLEY COAL CO. (Ager)—There is large local demand for coal from this property, 12 miles northeast of Yreka. The coal is used for domestic purposes at Yreka, Montague, Hornbrook and other towns. New ground is being explored with power drills.

Tuolumne County

CHEROKEE (Jamestown)—Preparations are being made for advancing long tunnel to tap pay gravel at a lower point than was reached in early days when Cherokee was a large producer.

Trinity County

HEADLIGHT (Carrville)—Development is in progress and it is reported that milling will be resumed early in 1914.

COLORADO

Clear Creek County

LOST TREASURE—New capital has been secured for development of this property on Columbia Mountain. Adit will be advanced several hundred feet and a winze will be sunk from adit level at a point 200 ft. from portal where a promising streak of smelting ore is exposed.

COMBINATION MILL (Idaho Springs)—Increase in tonnage delivered to this custom mill has necessitated a night shift. Plant is now receiving ore from Idaho Bride Mining Co., Specie Payment, and Golden Edge properties. Electric power has been substituted for water power during winter months, on account of difficulties due to low water and ice.

McCLELLAN—A rich discovery has been made in this mine on Leavenworth Mountain which has been developed by lessees during last year. A 14-in. streak of ore assays 1100 oz. silver per ton, and rest of vein, which had a total width of 32 in., assays 230 oz. silver per ton. Discovery was made in Martine level 450 ft. from portal of tunnel and 185 ft. below surface.

Eagle County

NORTH DAKOTA (Eagle)—It is reported that a discovery has been made of a vein 5 ft. wide which yields ore assaying 460 oz. silver per ton through its entire width. Mine is under lease to Marion Henry Mining Co. and adjoins the Lady Belle, which is shipping a carload of ore every other day.

El Paso County

DOUGLAS RANCH (Colorado City)—A report said to be confirmed by freight agent of Denver & Rio Grande R.R. is to effect that three carloads or from 80 to 100 tons of copper ore worth from $75 to $80 per ton have been going out weekly from discovery on this ranch, north of Gleneyre, owned by Palmer estate. It goes to Omaha. Mine was discovered by W. E. Weeks, of Colorado City who kept find secret for some time. Ore is said to be siliceous and contains from 25 to 30% copper.

Lake County

SILVER BOW (Leadville)—In this mine which took over property of Big Four on Breece Hill, there has been opened a vein of gold-copper ore 1 ft. wide from which several carloads have been shipped returning from $250 to $300 per ton. It is now reported that ore 3 in. wide has come in on foot wall, from which 300 lb. of ore has been sacked which assays as high as 1000 oz. gold to the ton.

San Juan Region

ORE SHIPMENTS FROM SILVERTON for October totaled 149 carloads or 1984 tons of concentrates and 1220 tons of crude ore.

Summit County

IN MONTEZUMA AND SNAKE RIVER DISTRICTS more men are now employed than for several years and new orebodies have been discovered in old properties. A shoot of good-grade silver-lead ore, said to be 10 to 14 ft. wide, has just been opened in New Pennsylvania Mines Co.'s property.

Teller County

ELKTON CONSOLIDATED GOLD MINING CO. (Cripple Creek)—Fourth dividend of current year, of 2c. per share will be paid Nov. 24, amounting to $50,000 making total paid in dividends $3,270,000.

FOREST QUEEN—In this mine on Ironclad Hill, lessees Cox & Co. have opened an ore shoot from 4 to 5 ft. wide, and 100 tons have been shipped which it is estimated will yield about $30 per ton.

IDAHO

Boise County

DEWEY (Thunder Mountain)—C. N. Murphy, an old prospector associated with C. W. Dewey in operating a lease on this old mine, has, with one helper, just made a cleanup of $2000 in less than six days. Since latter part of April the two men took out $4800 by sluicing, and work was confined to old dump abandoned by owners of mine, when quartz mining stopped here about 10 years ago.

Cœur d'Alene District

AURORA SAMPSON (Burke)—Property consists of 14 claims. Work is being done on lower tunnel 2200 ft. long. Surface tunnels show oreshoot about 25 ft. long by 3 ft. wide. Ore is said to assay about 10% lead. New buildings have just been completed at lower workings.

MICHIGAN

Iron

SOO LINE SHIPMENTS of iron ore from Gogebic Range have suffered slight decrease for 1913. The 1913 tonnage to Oct. 28 was 789,800 against 878,740 tons last year. This decrease is due to closing down of Ashland and Harmony mines for considerable portions of present season, former being closed down for repairs and latter as result of water troubles.

ERNST (Commonwealth)—Orders were received lately to cut down working force at this Florence Iron Co. mine, leaving only 50 miners. At present there is only one other property working in Florence district, the Buckeye.

NEWPORT (Ironwood)—Management of this, the largest underground mine on any of the iron ranges, laid off 175 men a few days ago, owing to fact that Algoma Steel Co., of Canadian Soo, was obliged to cancel an order for about 75,000 tons of ore.

MINNESOTA

Cuyuna Range

COMPANIES ARE CURTAILING PRODUCTION on the Cuyuna Range for winter season; 75 men having been laid off at Armour No. 2 and Kennedy mines, and other mines are gradually reducing forces to winter basis. Barrows and Cuyuna-Mille Lacs are only two shafts now shipping their entire production, all other mines now stockpiling their product. Cuyuna-Mille Lacs will continue to ship throughout winter, product going all-rail to South Bethlehem, Penn., and other distant points. This is only mine on Cuyuna or Mesabi ranges to ship throughout year.

ORE SHIPMENTS to Nov. 1 exceed those of 1912 by 2,348,118 tons. Total for present year, to Nov. 1, is 37,942,412 tons. Complete summary for the month and season, comparing 1912 and 1913, is as follows:

Dock	Oct., 1913	Oct., 1912	Season to Nov. 1, '13	Season to Nov. 1, '12
D. M. & N. (Duluth)	1,689,427	1,686,324	11,520,153	9,415,511
Great Northern (Superior)	1,954,291	1,942,563	12,166,741	12,838,900
D. & I. R. (Duluth)	1,311,661	1,393,764	9,506,399	8,703,959
Soo (Superior)	82,272	61,108	680,213	261,047
C. & N. W. (Ashland)	380,998	640,608	3,258,167	3,494,097
Soo (Ashland)	116,954	219,108	798,587	880,780
N. P. (Superior)	4,219	.....	12,152	.....
Totals	5,539,832	5,843,475	37,042,412	35,594,294

CUYUNA-MILLE LACS IRON CO. (Crosby)—Arrangements are underway for doubling output. Full force of 120 men will be employed throughout winter.

ARMOUR NO. 1 (Crosby)—It is announced that mine will not be stripped, as has heretofore been belief. Pennington pit adjoins property and orebody is stripped to a point on boundary between properties.

PENNINGTON (Crosby)—Management has instructions to ship a trainload of 33% ore. Such material is ordinarily unmerchantable, but Pennington pit has a seam of this lean ore, mixed with free quartz, which operators believe it would be cheaper to ship than to waste.

CUYUNA-DULUTH IRON CO. (Ironton)—Officials have announced that Ironton shaft will be sunk 100 ft. deeper to 300 level, so as to enable shipments from two levels next season. Shipments have ceased for present season, but mine will operate continuously throughout winter, product being

DELL DEVELOPMENT CO. (Aitkin)—Construction on vertical "step process" furnace has suddenly ceased, and company has given up its options on manganiferous iron orebodies on Cuyuna range. Process was to be an adaptation of John T. Jones' furnace, and it was stated that manganese could be profitably removed from low-grade manganiferous iron ores such as abound on Cuyuna range. Officials of company will not state whether cessation of operations means an abandonment of idea or not.

Vermilion Range

LUCKY BOY-ANDERSON (Ely)—Good headway is being made straightening out shaft. A drift was driven in on 210-ft. level under vertical part of shaft and behind that portion which is inclined. A raise will now be lifted 20 ft. to connect with vertical part of shaft. This will give a vertical shaft for entire depth. Sinking will then be done on another level and drifts driven to ore.

MISSOURI-KANSAS-OKLAHOMA

Joplin District

G & E (Joplin, Mo.)—Car of zinc ore was recently shipped. Operations are conducted at depth of 145 feet.

HERMOSA (Carthage, Mo.)—Good zinc ore is being opened up and operators believe heavy weekly productions will result.

COON (Joplin, Mo.)—Zinc ore has been found at 91-ft. level, proving up drill records. Three drill holes showed ore from 91 to 105 feet.

MAYS & CO. (Thoms Station, Mo.)—Both lead and zinc are being hoisted from drifts entending from 150-ft. level. A concentrator formerly owned by High Tariff company is to be used.

NOWATA (Porto Rico, Mo.)—McCreight & Co. have taken lease on this old producer and are prospecting at 190-ft. level, with indications of developing another good run. Mine is in sheet ground district.

KEYS & JAMISON (Galena, Kan.)—Company is developing what is expected to be one of the best producers of camp. Operations are through an old shaft and ore that runs 10% is being hoisted. A large body has been blocked out. Mine is on Southside ground.

DOANE LAND (Joplin, Mo.)—Several small companies are operating successfully here. D. G. Doane & Son are prospecting a zinc orebody at 120 ft. White Swan and Grey Squirrel recently have opened good calamine deposits. Morgan and associates, on a nearby tract, are producing a heavy weekly tonnage of calamine and lead.

MONTANA

Butte District

NETTIE (Butte)—The Anaconda company has begun erection of surface buildings preparatory to sinking a deep shaft. Mine was closed a number of years ago after producing a large amount of silver, but was not developed below 450-ft. level.

TUOLUMNE (Butte)—Development work has opened up a new shoot of ore on 800 level that is most promising. It has a width of 12 ft. and assays over 4% copper. About 200 men are now working in mine, and shaft sinking is being continued to 2600 level, crosscuts to be run from stations at 2400 and 2600 levels.

BULLWHACKER (Butte)—Construction of large building for new generator which has been purchased has been started and every effort is being made to complete it early. New generator will afford ample current to precipitate 4400 lb. of copper daily. Bullwhacker leaching plant is now turning out several hundred pounds of copper daily.

BUTTE & ZENITH CITY (Butte)—All electrical equipment has arrived and work of installing new hoist has been commenced. Manager Newton says that he expects to be ready to resume sinking operations about Dec. 1. Shaft is now down a little over 500 ft. and intention is to sink to 1000 ft. before doing any crosscutting.

BUTTE & PENSACOLA COPPER MINING CO. (Butte)—This company, controlled principally by Butte men, is operating upon a group of 20 claims near the head of Logging Creek in the Little Belt mountains. Upon the Excelsior claim an opencut recently exposed a body of lead-carbonate ore carrying silver. A wagon road has been completed to the property and a tunnel started which is expected to tap the vein at good depth in a length of 1700 feet.

DAVIS DALY (Butte)—Annual report, dated Oct. 15, shows encouraging conditions, chief among them, fact that mine is now and has been for a period of four months, upon a paying basis. Hesperus is looking particularly good; rich ore is being taken from Colorado shaft; work is going on in various levels from 1000 to 1900 and lately announcement was made that Belmont vein from which still better things are expected, will be cut by Dec. 1. About 200 men are employed with a payroll of from $20,000 to $25,000 per month. Output is between 200 and 300 tons per day.

CORBIN COPPER CO. (Butte)—A suit for $3000 damages may be but the start of several of similar character. Company in opening up Gambrinus claim, located in a residential part of city erected a hoist and installed machinery and it is claimed that noise of blasting and operating of hoist has damaged all property in locality. Attorney M. J. Cavanaugh's home is within a short distance of shaft and he has started suit against company, claiming that his house has been damaged to amount claimed. It is stated by others that they also propose to bring suits, but it is probable that no more will be commenced until this one is decided.

ELM ORLU (Butte)—W. A. Clark has confirmed report to effect that he has entered into a contract with Minerals Separation company for use of its process in his new concentrator. Clark investigated through experiments made with ore from his Elm Orlu mine working of process and satisfied himself that it was best he could possibly secure. During recent hearing of injunction sought by Minerals Separation company against Butte & Superior company, W. A. Clark, Jr., who is associated with his father, attended different sessions of court and watched with closest interest demonstrations given by experts from Utah and other places of use of oil process.

NORTH BUTTE—Preparations are underway to erect a new hoisting plant at Granite Mountain shaft, which will eventually become principal hoisting shaft. Hoist is to be of Ward Leonard type with motor-generator, flywheel set. Hoist proper will be run by direct-current motor of 6000 hp., direct connected to hoisting drums. Mechanical part of hoist will be furnished by Wellman-Seaver-Morgan company, and electrical part by Westinghouse company. Close to 40,000 tons of ore was mined at North Butte mines during month, producing nearly 2,500,000 lb. of copper. Between 900 and 1000 men are employed at Speculator where monthly payroll is $110,000.

NEVADA

Clark County

ARROWHEAD PLASTER CO. (Moapa)—Name of Moapa Gyp Co. has been changed to Arrowhead Plaster Co. Plant is near Moapa, and office is in Los Angeles, Calif.

Douglas County

BUCKEYE PLACER (Gardnerville)—It is stated that a dredge will be installed on this ground. Expense of obtaining sufficient water has prevented earlier working.

Humboldt County

ALMA (Seven Troughs)—This group of five claims adjoining Badger Hills on north was sold recently. Development work will begin at once.

Lyon County

OIL INDICATIONS have been found near Buckskin.

BLUE JAY (Yerington)—The air line from New Yerington compressor plant is completed and machine drills are in operation. Development on the 200- and 400-ft. levels is being continued.

MASON VALLEY MINES CO. (Thompson)—Ore receipts at the smelting plant for week ended Nov. 6, 1913, were as follows: From Mason Valley mine, 2106 tons; from Nevada-Douglas, 1279 tons; from other mines, 756 tons; total, 4141 or a daily average of 592 tons. During same week six cars of matte were shipped.

Mineral County

TWO PERCENT. MERCURY ORE has been found in the cinnabar district east of Mina.

McNAMARA (Juniper)—Ore is being milled in two-stamp mill at Athens. Stamps are of special, rapid return, spring design.

Nye County

BIG PINE (Manhattan)—Test run on surface and 200-ft. level ore gave $12 per ton.

MANHATTAN AMALGAMATED (Manhattan)—Change in hoisting plant at Wilson lease caused a shutdown for a week.

MANHATTAN MILLING & ORE CO. (Manhattan)—The 10-stamp mill will be increased to 35, the 25-stamp mill of Bullfrog-Homestake having been purchased.

NEVADA CINNABAR CO. (Ione)—The 50-ton furnace is nearing completion, after which two months must be allowed for drying. It is expected to have furnace in operation shortly after first of year. Company is largest producer of mercury in state of Nevada.

Storey County

WASHINGTON & NEVADA DEVELOPMENT CO. (West Comstock)—A complete 10-stamp mill, equipped for concentration and cyanidation, will be installed. Property is five miles west of Virginia City.

UNITED COMSTOCK PUMPING ASSOCIATION (Virginia City)—Progress is being made on Starrett pump installation in the old Consolidated Virginia winze on 2500-ft. level of C. & C. shaft. On the surface wiring for compressor is being installed.

STURGIS GROUP (Gold Hill)—Two Byron Jackson sinking pumps will be installed in joint incline of Crown Point and Belcher to unwater Yellow Jacket, Crown Point and Belcher below 1400-ft. level. Discharge pipe to Sutro tunnel drain is completed; 100 gal. per minute is being pumped from Jacket incline. Yellow Jacket mill was started recently after being thoroughly overhauled and repaired. Yellow Jacket dump rock and Belcher ore are being treated. Good-grade ore is being developed on 1300-ft. level of Belcher.

White Pine County

CONSOLIDATED COPPERMINES CO. (Ely)—About 2,000,000 tons of porphyry ore running about 1.7% copper have been added to reserves. Ore was opened up by Nevada Consolidated, which, in seeking an outlet from its Liberty pit over Giroux ground, uncovered the find. Temporarily, at least, Giroux has abandoned underground mining as a result of this porphyry development and since Aug. 20 all shipments have been from steam-shovel operations in this territory. To date about 180 cars of this ore have been shipped to Steptoe plant for treatment and until existing contract between Nevada Consolidated and Giroux for handling latter's ores expires next June by request of shipping company, production will continue to come from this portion of the Giroux property. Nevada Consolidated will do actual mining but Giroux company furnishes steam shovel. In Morris workings, formerly operated through the Morris shaft, stripping has been done over an area 900 ft. long by 600 ft. wide. To a depth of 255 ft. this plot is estimated to contain 4,000,000 tons, of 1.8% copper ore.

NEW MEXICO

Grant County

AT PHELPS-DODGE PROPERTIES in the Burro mountains it was lately stated by men in charge that about 5000 ft. of the 7000-ft. tunnel between the No. 2 and No. 3 shaft, had been driven. Within a month the tunnel should be completed. Work was started this week on pumping water from No. 3 shaft.

J. A. PETERSON & CO. (Pinos Altos)—Milling machinery is being shipped from old Comanche mill at Silver City to the plant under construction at Pinos Altos. It is thought operations will begin about Dec. 15.

Socorro County

SOCORRO MINING & MILLING CO. (Mogollon)—Old shaft, leading to first stopes, has been converted into a waste chute and rock from present workings is dumped into it.

PACIFIC MINES CO. (Mogollon)—Foundations for electric hoist and compresser have just been completed and air pipe laid in mine. New hoist is directly behind gasoline hoist and latter will be kept in position for use in emergencies.

LINCOLN MINING & DEVELOPMENT CO. (Mogollon)—Work enlarging station over winze for accommodation of new gasoline hoist and compressor has been completed and everything is in readiness for machinery's installation on its arrival.

Union County

CROZIER & CORDOZA (Hayden)—A shipment of ore has just been made from these claims. From a shipment of about 20 tons it is reported owners netted $400. Ore ran about $18 per ton in gold with some silver.

OREGON

Baker County

STRIKE ON THE SUMPTER VALLEY R.R., which taps a number of mining camps in the county, was to take effect Nov. 5, because of dismissal of Guy L. Anderson, general manager of the road.

BELMONT (Greenhorn)—A strike of a rich oreshoot in this mine has stirred up much interest. Mine has been in operation for about 12 years and is owned by Gilkey & Kershaw. Early in its history some rich deposits were opened. Samples taken at this strike run from $1000 to $2000 per ton in gold. These samples were taken from a new shaft that is being sunk. Low-grade ore runs from $40 to $60 per ton.

Josephine County

GRAND PRIZE PLACER (Sucker Creek)—Thomas ("Dry Wash") Wilson, one of the best known mining men of Nevada, has bought this rich placer mine, paying for it $100,000. T. M. Anderson, owner and discoverer, secured a good payment down and new owner will equip mine and pay balance out of earnings. Anderson discovered this mine last February, it is in a dry gulch and he had to pack gravel a mile on burros to water, where it was washed and yielded as high as $25 per yard. Deposit of pay is extensive, plans have been made and pipe is now on ground to equip mine and make it one of the leading placers of the county. Water will be piped three miles to get the desired head.

SOUTH DAKOTA

Lawrence County

TITANIC—Three new Ingersoll-Rand air drills have been delivered, two being "jackhamers," other a piston machine. Small drills will be used in sinking Combination shaft, which is now 140 ft. deep, and piston machine for lateral work on 100-ft. level. Workings are being kept dry by removing water from Iron Hill shaft, a short distance away. Using a 300-gal. skip about 1½ hr. daily in this shaft keeps Combination workings free from water. Commissioners of Lawrence County have agreed to advance $100 to repair wagon road from Trojan to Carbonate, which will partially pay for work required. Such a road would make considerable saving in expense of hauling fuel and supplies to property.

Pennington County

HILL CITY MINING & DEVELOPMENT CO. (Hill City)—This company a few days ago secured permission from state securities commission to sell its stock in the state, proceeds to be used in equipment and development of property. Steam mining plant is being installed.

UTAH

Beaver County

LEONORA (Milford)—A shaft is being sunk to depth of 300 ft. Ore has been produced from surface workings.

SHEEP ROCK—A 5-stamp mill is being operated. It is stated that there is ore enough developed to supply this mill for two years.

MOSCOW (Moscow)—October shipments amounted to 11 cars or about 550 tons. Sinking is in progress, and shaft is down 110 ft.; about three feet a day is made. Most of the ore is being mined on 700- and 800-ft. levels, and a strike on latter level is reported. It has not yet been proved whether this is a new vein or a continuation of shoot opened from surface to 700. Company has been shipping regularly since 1905, and in last three years has paid about $40,000 in dividends.

Juab County

TINTIC SHIPMENTS FOR OCTOBER amounted to 551 cars; those for the week ended Nov. 7 to 142 cars.

Salt Lake County

BINGHAM-NEW HAVEN (Bingham)—Dividend of 10c. per share, amounting to $22,500, has been declared.

Summit County

PARK CITY SHIPMENTS FOR OCTOBER amounted to 5755 tons, by Silver King Coalition, Daly West, Daly-Judge, Ontario, Thompson-Quincy, American Flag and John The Revelator. Shipments from the camp for the week ended Nov. 8 amounted to 1573 tons.

SILVER KING COALITION (Park City)—During October, company shipped 2181 tons of ore and concentrates. About 100 tons of ore daily has been mined, greater part being of shipping grade. Milling ore concentrates about six into one. New equipment has been installed, and conditions are generally promising. A 15c. dividend is expected before Christmas.

SILVER KING CONSOLIDATED (Park City)—James Duffy, superintendent, has resigned, and Joseph Kemp, formerly in charge of Little Bell mine, will take his place. Development is being done to reach cut near 1480-ft. level. Two drifts are being driven on the 1500. A part of the work has been in ore, which is being sorted and saved for shipment. Further development will be necessary, before production on a larger scale is undertaken.

Tooele County

MAYFLOWER (Grantsville)—Work is being done from bottom of 200-ft. inclined shaft. Rock mineralized with copper and silver has been cut.

BULLION COALITION MINES CO. (Stockton)—Company has taken over old Honerine property, and is using water from workings to develop agricultural land. This is bringing good returns.

MICHIGAN-UTAH (Bingham)—Work has been resumed to connect Utah Mines Coalition side of property in Big Cottonwood with the City Rocks workings on Alta side. This will take several weeks, and when completed, will allow of more economical handling of ore. Vertical distance between main levels is 312 ft. Ore from Big Cottonwood side is to be hoisted to upper level, and sent down over five-mile tramway on Alta side. This will cut out hauling down Big Cottonwood by team.

WASHINGTON

Stevens County

HECLA (Chewelah)—Work is to continue throughout winter under direction of J. C. Argall.

UNITED COPPER (Chewelah)—Scale of operations has been incresed by addition of 12 stamps, and over 100 tons of ore is now going through mill daily.

WISCONSIN

Platteville District

NEW HOPE (Platteville)—A good run of lead ore has been uncovered on Segelke land just east of old Acme shaft.

BELOIT-ELMO (Platteville)—This mine, four miles south of Platteville, is again active; shipments of lead ore are being made from top run.

GREAT WESTERN (Galena)—This company has purchased Calvert mill which will be moved to Pittsburgh leasehold four miles south of Galena.

WEIGEL (Linden)—Pollard & Saxe are making weekly shipments of one to three cars of lead and zinc ore from old Platteville-Linden mine recently acquired by them.

ROSS LAND (Rewey)—A shaft has been started on Ross Land at Crow Branch, two miles west of Rewey. Eight drill holes showed 15 ft. of rich jack. This territory, formerly lead production has not been developed heretofore for zinc ore.

CANADA

British Columbia

CHANGE IN TARIFF rate for shipments of ore to Trail smelting works went into effect Nov. 12. Previous rate of 20c. per ton has been raised to 30c. per ton on ore shipped from Rossland to Trail, when the shipment is less than 10 cars to the train.

NOBLE FIVE (Slocan)—Development will be commenced this month by beginning to drive a 2000-ft. tunnel.

COPPER QUEEN (Vananda, Texada Island)—Granby Consolidated company is commencing work under option of purchase.

SURPRISE (Sandon)—From 100 to 120 tons of high-grade ore are being mined monthly. Mine has ore in all drifts from raise, and new oreshoots are being uncovered as development work progresses.

IRON MASK (Kamloops)—Ore is being shipped to Trail from Erin claim of Iron Mask group. Induction motors and other electric machinery is being installed preliminary to resuming work in main workings.

JEWEL (Greenwood)—Mine and 15-stamp mill are being operated after long period of non-productiveness. Ore is gold-quartz; it has been opened to a depth of 330 ft. and reserves are sufficient to supply mill for considerable time.

Ontario

KERR LAKE (Cobalt)—Quarterly dividend of 5% will be paid Dec. 15.

CARIBOU (Cobalt)—It is announced that company will declare a dividend of 2½%.

BEAVER (Cobalt)—After having passed several quarterly dividends, directors have declared 3% payable in December.

MAPES JOHNSTON (Cobalt)—A majority interest in this property has been sold to Brantford syndicate, which has been carrying on work.

BURNSIDE (Swastika)—It is stated that C. A. Foster has made a deal with an English syndicate for sale of Burnside and Tough-Oakes properties.

PETERSON LAKE (Cobalt)—Boundary dispute with Nipissing has finally been settled and there is now no fear of another expensive lawsuit over this matter.

VIPOND (Schumacher)—Property is being pumped out to permit of an examination by Crown Reserve Mining Co. Crown Reserve also has North Thompson claim under option.

COBALT TOWNSITE (Cobalt)—Company has now taken over Northern Customs concentrator. Tramway to property in Cobalt will shortly be completed and mill will treat nothing but Townsite and City of Cobalt ore.

MEXICO

Sonora

EXPORTS FOR OCTOBER, through Port of Agua Prieta, are as follows: Nacozari, 13,185 tons; El Tigre, 329; El Gallo, 413; Santa Margarita, 421; La Republica, 21; San José, 38; San Ygnacio, 21; Estrella, 316; La Blanca, 33; La Ventana, 28; La Bellota, 19; El Padazo, 42; La Cartera, 29; Alemana, 29; La Sonora, 101; Alicia, 29; Agua Buena, 21; Matilde, 14; Panama, 33; total, 288 cars, or 15,127 tons. El Tigre also shipped 69 bars of gold and silver bullion weighing 9651 lb. Estimated values, Mexican, are copper, 2,173,600 pesos; silver, 985,700 pesos; gold 596,500 pesos or 3,755,800 pesos total value of ore exports for October.

CONSOLIDATED VIRGINIA (Moctezuma)—An examination is being made by S. M. Soupcoff for Colorado men.

AGUA BUENA (Nacozari)—J. A. Judah, who is one of the principal owners, is operating mine for company and expects to ship about two cars per month of silver-lead-copper ore.

MONTE CRISTO (Moctezuma)—Sale of mine has just been completed in El Paso and new company will proceed with the work at once. The day sale was made a rich shoot of silver glance was encountered on fifth level.

EL TEMBLOR (Esqueda)—A cross vein has been encountered, ore in which is richer than old vein and shipments of mine have been doubled. Mill is running steadily and making a concentrate that contains 250 oz. silver and 3 oz. gold per ton.

LA UNION (Fronteras)—Two cars of 20% copper ore are now on the way to smelters at Douglas and shipments will be increased to one car per week next month. Present vein is from 2 to 10 ft. wide and about one-half mile long. A cut has been made along top of vein exposing many tons of ore.

NACOZARI CONSOLIDATED COPPER CO. (Nacozari)—First car of machinery for new concentrator has arrived and erection has commenced. One car of crude ore of shipping grade is out and will be shipped to El Paso for trial and if satisfactory other shipments of crude ore will follow and only low-grade ore will be milled. Three shifts are now employed in mine working 40 men.

BRITISH GUIANA

GOLD EXPORTS for the nine months ended Sept. 30 were 48,093 oz. fine, valued at $994,092; an increase of $418,793 over last year. Exports of diamonds were 4785 carats, valued at $46,085; an increase of $26,246 over last year.

BELGIAN CONGO

UNION MINIERE (Katanga)—This company, according to a U. S. consular report, has added new equipment at the Lubumbashi smelting plant which will now be able to produce 800 to 1000 tons of copper monthly.

INDIA

KOLAR GOLDFIELD—The total production in October was 49,824 oz., being 685 oz. more than in September. For the 10 months ended Oct. 31 the total was 482,883 oz. in 1912, and 489,134 oz.—or $13,110,409—in 1913; an increase of 6251 oz. this year.

CHOSEN

ORIENTAL CONSOLIDATED—September production was $125,952, net profit $33,110.

THE MARKET REPORT

METAL MARKETS

NEW YORK—Nov. 19

In line with our policy to quote the market for only one kind of each metal, and that the kind that is most important as a commodity, we shall at the end of this year discontinue a regular quotation for casting copper, and shall quote it only occasionally, when its conditions may vary from those of the main copper market. We shall continue regularly to quote Lake copper because of the long record of this metal, but it will then be the only distinction that we make in the cases of any of the nonferrous metals. In copper, electrolytic is, of course, the governing kind of metal and the one that is truly representative of market conditions.

MONTHLY INDEX NUMBERS

Month	1912	1913	Month	1912	1913	Month	1912	1913
Jan.....	111	126	May.....	118	126	Sept.....	127	118
Feb.....	109	125	June.....	117	117	Oct.....	133	114
March.....	111	125	July.....	114	110	Nov.....	129	...
April.....	115	124	Aug.....	120	116	Dec.....	129	...

Average for year 1912, 119; year 1911, 112; year 1910, 115; year 1909, 115
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Copper, Tin, Lead and Zinc

Copper—During the last week the copper market experienced a further decline and was weak throughout. Consumers held off and sellers endeavored to find a level at which buyers would be interested. Some sales were made on Nov. 13 at 15⅜@15¼c., delivered, but after that offers to sell at 15⅜c. that were made right along failed to command business, and such as was done was at 15¼c., delivered. On Nov. 17 there were some considerable sales at 15c. cash, New York.

The several agencies, with a single exception, engaged in active competition for such business as appeared in sight. On Nov. 19 the largest agency, which previously was standing aloof, was reported out with a price around 15⅜@15½c., delivered, but this was still above the market and was considered to be more a new basis to figure from than anything else.

The market of the last week is rated as quiet, though sales amounted to some millions of pounds. Their aggregate was more than in the previous week. Almost everything was for shipment to Europe. Sales to domestic consumers were insignificant.

The situation in Lake copper remained unchanged. No new price by the Calumet & Hecla has been reported.

The accumulation of casting copper increased further during the week, and this metal was further pressed for sale.

The European statistics for the first half of November again showed a decrease and the visible supply is very low. On the other hand, the consumption of copper, in this country without doubt and Europe perhaps, shows a falling off, and the question at the present moment is, whether, irrespective of the stocks, production is not proceeding at a larger rate than consumption.

Electrolytic in cakes, wirebars or ingots, at the close is quoted 15@15.05c. We quote casting copper nominally at 14⅝@14¾c. as an average for the week.

The London standard market was £68 for spot and £67 7s. 6d. for three months on Nov. 13 and 14, declined on Nov. 17 to £67 15s. for spot and £66 15s. for three months. On Nov. 18 the scarcity of near-by copper made itself felt and spot moved to £69 10s., while three months advanced to only £67. On Nov. 19 the market closed at £68 7s. 6d. for spot and £66 17s. 6d. for three months. In general, the standard market has been very dull.

Base price of copper sheets is now 22c. for hot rolled and 23c. for cold rolled. Full extras are charged and higher prices for small quantities. Copper wire is 17¼@17¾c., carload lots at mill.

Lead—The market is quiet and the metal is being offered at lower prices, 4.12½@4.17½c. St. Louis, and 4.27½@4.32½c., New York.

The London market has been somewhat easier. Spanish lead is quoted £19 2s. 6d.; English lead 5s. higher.

Tin—The market continued to display considerable strength. Consumption in this country seems to be improving, and orders from this side were plentiful. These imparted a good tone to the London market, finding expression in heavy purchases of three months tin, which is selling at over £1 above spot. The market closes firm at £181 15s. for spot and £182 15s. for three months, and about 40¼c. for December tin here.

Spelter—The market is quiet. Consumers are thought to be not well covered, but they are holding off, and on the other hand, there has been some pressure by smelters to sell. In consequence the price has gone off somewhat, and at the close St. Louis is quoted 5@5.05c., and New York 5.15@5.20 cents.

The London market is slightly better than last week, good ordinaries being quoted £20 15s.; specials, £21 8s. 9d. per ton.

Base price of sheet zinc in carload lots is $7.50 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS

NEW YORK

Nov.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
13	4.8515	59½	*15½ @16½	15.05 @15.15	40	4.27½ @4.32½	4.12½ @4.17½	5.20 @5.25	5.05 @5.10
14	4.8515	59½	*15½ @16½	15.05 @15.10	40	4.27½ @4.32½	4.12½ @4.17½	5.20 @5.25	5.05 @5.10
15	4.8540	59⅜	*15½ @16½	15.05 @15.10	40	4.27½ @4.32½	4.12½ @4.17½	5.15 @5.20	5.00 @5.05
17	4.8535	59	*15½ @16	15.00 @15.05	39½	4.27½ @4.32½	4.12½ @4.17½	5.15 @5.20	5.00 @5.05
18	4.8440	59¼	*15½ @16	15.00 @15.05	40¼	4.27½ @4.32½	4.12½ @4.17½	5.15 @5.20	5.00 @5.05
19	4.8540	59	*15½ @16	15.00 @15.05	40¼	4.27½ @4.32½	4.12½ @4.17½	5.15 @5.20	5.00 @5.05

*Nominal.

The quotations herein given are our appra'sal of the market for copper, lead, spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

Nov.	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
13	27½	68	14.78	67⅞	74	181½	182½	19¼	4.18	20⅝	4.48
14	27½	68	14.78	67⅞	74	181½	182⅞	19	4.13	20⅝	4.48
15	27 7/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
17	27¼	67⅞	14.72	66⅞	73⅞	180	181½	19	4.13	20⅝	4.48
18	27⅜	69½	15.10	67	73½	181⅞	183	19½	4.16	20⅝	4.48
19	27½	68⅜	14.86	66⅞	73½	181¼	182¾	19½	4.16	20⅜	4.51

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21½c.

Other Metals

Aluminum—Current demand continues light and the market is dull. Not much improvement is expected until there is some turn in the automobile business. Quotations are a little uncertain, the range being about 19¼@19¾c. for No. 1 ingots, New York.

Antimony—The market is rather quieter than it has been lately. Quotations are a trifle easier. Cookson's is 7.60@7.70c. per lb., and Hallett's 7,25@7.40c.; while 6.35@6.50c. per lb. for Chinese, Hungarian and other outside brands.

Quicksilver—Business has been rather quiet, but the market is steady, and there is no material change in prices. The New York quotation is $38.50 per flask of 75 lb. with 56@57c. per lb. for retail lots. San Francisco price is $38.50 per flask, with special terms for export business. The London price is £7 5s. per flask, with £7 quoted from second hands.

Cadmium—German quotation is 750 marks per 100 kg.—equal to about 81c. per lb.—f.o.b. works in Silesia.

Nickel—Quotations for ordinary forms, shot, blocks, or plaquettes are 40@45c. per lb., according to size of order and quality. Electrolytic nickel is 5c. per lb. higher.

Selenium—For large lots, 100 lb. or over, $3@3.25 per lb. is quoted; while $5 per lb. is paid for retail orders.

Gold, Silver and Platinum

Gold—The price on the open market in London was unchanged at the Bank level—77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was some talk of purchases for New York account, but none were made.

Imports of gold into France, eight months ended Aug. 31, were 404,607,000 fr.; exports, 50,103,000 fr.; net imports, 354,504,000 fr., against 151,450,000 fr. last year.

Iridium—The market is unchanged, sales being made at $80@81 per oz., New York. Supplies are a little larger than they were.

Platinum—Business is improving slightly, but quotations are still rather easy, at $43@44 per oz. for refined platinum. Hard metal is rather lower, $48@50 per oz. being named.

Silver—The market has fallen ¼d. in London the past week owing rather to want of buying orders than to large offerings. The market closes at 27¼d, quiet with general tendency very uncertain.

Shipments of silver from London to the East, Jan. 1 to Nov. 6, as reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India	£9,089,500	£9,001,500	D. £88,000
China	1,327,000	752,000	D. 575,000
Total	£10,416,500	£9,753,500	D. £663,000

Messrs. Samuel Montagu & Co. write from London: "Shanghai reports a stock of £6,225,000 compared with £6,250,000 last week. It appears to be well known that between £1,500,000 and £2,000,000 of this stock is deposited with the banks, foreign and native, mainly with a view to safe custody. A reabsorption of this amount for trade purposes would reduce the present stock to about £4,225,000, at which it would not look quite so unwieldy. Now that unrest in China has simmered down, there is a possibility of such a reduction taking place."

Zinc and Lead Ore Markets

JOPLIN, MO.—Nov. 15

The high price of zinc blende is $46, the base per ton of 60% zinc ranging from $42.50 to $43.50—one of those rare weeks when the margin of extreme narrows almost to a level for all grades of ore. There was light buying early in the week, buyers expecting to cover orders at last week's quotation or lower, but spirited buying on Friday and Saturday ran the low base up $1 and high base 50c. per ton. Calamine is unchanged and firm on a base of $21@23 per ton of 40% zinc. The average price of all grades of zinc is $41.12 per ton. The highest price reported paid for lead was $54.50, the base per ton of 80% metal contents $52 and the average of all grades $51.96 per ton.

SHIPMENTS WEEK ENDED NOV. 15

	Blende	Calamine	Lead	Value
Totals this week	10,591,850	744,730	1,838,080	$280,895
Totals 46 weeks	504,385,410	38,169,110	83,854,000	$13,732,129

Blende value, the week, $223,480. 46 weeks, $11,912,706.
Calamine value, the week, $9665; 46 weeks, $491,164.
Lead value, the week, $47,750; 46 weeks, $2,228,269.

PLATTEVILLE, WIS.—Nov. 15

The base price paid this week for 60% zinc ore was $41@43 per ton. The base price paid for 80% lead ore was $53 per ton.

SHIPMENTS WEEK ENDED NOV. 15

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	3,235,660	165,300	829,960
Year to date	129,852,370	6,020,850	50,888,860

Shipped during week to separating plants, 2,713,380 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—Nov. 19

While new orders are still reported slow, there are several points which indicate that business is not coming to a standstill yet. Railroads continue to make some purchases; pipe of all kinds is in heavy demand; wire, tinplate and some other kinds of small materials are selling freely.

Structural steel is likely to be in demand for some time yet. Apart from large building operations on private account, New York will need some 80,000 tons of steel for subway work, and the contracts are now being let, or will be let soon.

Sales of foreign material do not seem to be made, though some brokers are offering German steel. Business abroad is improving a little, and no large transactions here are likely. The possibility of imports, however, may exercise some restraining influence on prices. Probably it has already done so in the case of billets.

Pig iron is slow, and prices rather weak. Business in seaboard territory is better than in the West. Prices are not especially strong.

Foreign Trade of the United States in iron and steel and machinery, nine months ended Sept. 30, is valued as below by the Bureau of Statistics of the Department of Commerce:

	1912	1913	Changes
Exports	$213,699,572	$226,481,976	I. $12,782,404
Imports	21,111,860	25,716,377	I. 4,604,517
Excess, exports	$192,587,712	$200,765,599	I. $ 8,177,887

Actual tonnage of iron and steel, so far as reported was this year 2,108,079 tons; imported, 244,156 tons. In some important lines only values are given.

PITTSBURGH, PENN.

Orders for pig iron and finished steel products have continued to decrease. New bookings in finished steel are considerably less than 50% of the full capacity, but there is some old business still to be filled, and the mills are running at close to 60% of the full finishing capacity. Pig-iron production shows a higher percentage between 75 and 80%, but further blowing out of furnaces will occur before the close of the month.

Pittsburgh was visited by a small flood at the beginning of the week, a rare event in November, and a few plants were closed for two days.

Steel prices show hardly as much sagging tendency as they did last month. Plates, shapes and bars are still generally quotable at 1.30c., Pittsburgh, but it is not difficult to shade the price with attractive plate orders. Bars have sold at considerable cuts, in the case of Atlantic seaboard delivery.

The opinion is growing that there will be an early revival in demand, though there are few who expect full operations in the steel industry in less than six months.

Pig Iron—Only eight of the 17 merchant furnaces in the Mahoning and Shenango valleys are in blast, and these are running chiefly on old contracts. The large curtailment in output has not steadied the market as expected, since Cleveland furnaces are prepared to compete for Pittsburgh trade with the Valleys. Transactions have been light the past week, and there are reports that pig iron can be secured at less than previously quoted prices. We quote: Bessemer, $15.25; basic, $13.25; No. 2 foundry, $13.50; forge, $13.25, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market continues very quiet. Prices are unchanged at $50, Baltimore, for English and $49.50, for German.

Steel—The market continues stagnant as to actual transactions, and is not quotably lower, at $20.50 for billets, $21.50 for sheet bars and $26 for rods, f.o.b. maker's mill, Pittsburgh or Youngstown.

IRON ORE

Imports and exports of iron ore in the United States, nine months ended Sept. 30, in long tons:

	1912	1913	Changes
Imports	1,539,452	1,916,733	I. 377,281
Exports	893,924	826,584	D. 67,340

Imports of ore this year included 1,177,665 tons from Cuba, 277,129 from London, 162,148 from Newfoundland, 132,832 from Canada; the balance coming from other countries. Exports were chiefly to Canada.

Imports of manganese ore for the nine months were 181,629 tons in 1912, and 258,074 in 1913; increase, 76,445 tons.

COKE

The Connellsville coke market has been irregular and prices have a lower tendency. Contracts for furnace coke are rather slow, and those closed do not cover long periods. Both producers and consumers are not anxious to go far ahead. Production is fair, though a little off from the highest point.

Exports and Imports of Fuel in the United States nine months ended Sept. 30, long tons:

	Exports		Imports	
	1912	1913	1912	1913
Anthracite	2,601,631	3,173,002	1,030	836
Bituminous	10,983,293	13,793,963	1,185,064	1,035,887
Coke	618,450	662,863	69,572	58,838
Bunker coal	5,495,719	5,687,644	.....	.....
Totals	19,699,093	23,317,472	1,255,666	1,095,561

The bunker coal or coal furnished to steamships in foreign trade is practically all bituminous. The larger part of the trade, both exports and imports, is with Canada. The totals show an increase of 3,618,379 tons, or 18.4%, in exports; and a decrease of 160,105 tons, or 12.7% in imports.

CHEMICALS

NEW YORK—Nov. 19

The general market remains rather quiet with only a moderate amount of business forward.

Arsenic—The market remains featureless, with small demand and good supplies. Prices are unchanged, about $3 per 100 lb. being asked.

Copper Sulphate—Business has been fair. Prices are unchanged at $5 per 100 lb. for carload lots and $5.25 per 100 lb. for smaller parcels.

Nitrate of Soda—The market has not yet recovered from the recent break, and business is slow. Prices are unchanged, at 2.25c. per lb. for spot, 2.30c. for December and 2.35c. for January-May deliveries.

Potash Salts—Exports of potash salts from Germany for the nine months ended Sept. 30, were, in metric tons:

	1912	1913	Changes
Crude salts	920,171	1,106,842	I. 186,671
Potassium chloride	216,322	264,133	I. 47,811
Potassium sulphate	61,040	92,404	I. 31,364
Pot.-magnesium sulphate	41,597	47,273	I. 5,676
Totals	1,239,130	1,510,652	I. 271,522

Of the total exports this year 761,613 tons, or 54% went to the United States.

Sulphur—Messers. Parsons & Pettit, New York, send us the following figures for Sicilian sulphur for the period of 14 months from July 1 to Aug. 31, of the next year, in metric tons:

	1911–12	1912–13	Changes
Stocks, July 1	525,563	444,381	D 81,182
Production	333,456	349,602	D. 16,854
Total	892,019	793,983	D. 98,036
Exports	447,638	434,473	D. 13,165
Stocks, Aug. 31	444,381	359,510	D. 84,871

F. Baller & Co., Messina-Catania, write of these figures "The decrease in production is due to various factors: First, several mines had to be, and are still closed down owing to explosions, fires, etc.; secondly to the dearth of labor consequent on the great emigration, and thirdly, that some mines are becoming exhausted or have to be worked at such depths that their exploitation is becoming unprofitable. Should emigration continue in its present proportions, a further reduction in the production is not impossible. The Consorzio has already disposed of its actual stocks and also part of the future production for delivery up to 1918, and at present, it refuses to entertain any business for delivery exceeding 15 days hence. The finer qualities are very much reduced, those existing in large quantities being the lower grades, especially current thirds, the sale of which abroad is not easy. The increase in salaries, cost of coal, wood, etc., has placed the producers in a critical position, and a strong agitation has been started to obtain an increase in the selling price. It seems that some of the members of the Consorzio board are not opposed to an increase, and it is therefore not unlikely that it will be voted."

PETROLEUM

A report from U. S. Consul, L. A. Davis, at Batum, Russia, says that the Transcaucasian State Ry., after negotiating unsuccessfully with Rumanian producers, has contracted for 2,500,000 poods (301,200 bbl.) of crude oil from a Mexican firm at 40 kopeks per pood ($1.72 per bbl.) delivered at Batum. A further contract for 15,000,000 poods is under negotiation. The closing of the first contract brought the price of fuel oil at Batum down from 65 to 43 kopeks per pood.

COPPER SMELTER'S REPORTS

This table is compiled from reports received from the respective companies except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97%. In computing the total American supply duplications are excluded.

	June	July	August	September	October
Alaska shipments	2,203,191	2,705,136	1,847,785	2,261,216	1,951,883
Anaconda	21,500,000	22,100,000	22,500,000	22,600,000	18,400,000
Arizona, Ltd.	2,600,000	2,600,000	1,800,000	1,800,000	3,550,000
Copper Queen	7,477,936	8,369,607	8,252,404	8,434,803	8,292,929
Calumet & Ariz.	4,000,000	3,800,000	4,500,000	4,000,000	4,500,000
Chino	3,682,706	4,831,185	6,050,867	4,308,296	4,196,296
Detroit	1,750,601	1,549,224	2,187,223	2,102,818	1,861,878
East Butte	1,055,646	1,060,257	1,162,007	1,233,018	.....
Giroux	598,240	584,546	524,953	198,178	.....
Mason Valley	1,097,014	908,892	867,060	918,000	1,052,000
Miami	2,512,000	.....	.....	.....	.....
Mammoth	1,750,000	1,800,000	1,750,000	1,750,000	1,700,000
Nevada Con.	6,344,863	5,403,919	5,989,973	4,441,671	.....
Ohio	537,400	601,700	689,000	685,900	.....
Old Dominion	2,511,000	2,526,000	2,524,000	2,679,000	2,037,000
Ray	4,392,612	4,097,000	4,269,519	4,336,434	.....
Shannon	924,000	880,000	1,248,000	1,232,000	1,216,000
South Utah	185,000	140,000	223,498	241,843	.....
Tennessee	1,379,220	1,247,804	1,101,019	1,309,985	1,392,162
United Verde*	2,900,000	3,000,000	3,000,000	3,000,000	.....
Utah Copper Co.	11,637,949	9,849,043	10,302,251	11,463,905	9,929,478
Lake Superior*	16,500,000	17,500,000	9,700,000	6,950,008	5,500,000
Non-rep. mines*	6,000,000	6,200,000	6,200,000	6,000,000	.....
Total prod.	104,051,138	101,758,167	96,769,607	91,947,075	.....
Imp., bars, etc.	18,255,267	29,029,990	22,474,471	35,703,660	.....
Total blister	122,306,405	130,788,157	119,244,077	127,650,735	.....
Imp. ore & matte	7,497,002	8,527,046	9,171,351	10,800,162	.....
Total Amer.	129,803,407	139,315,203	128,415,428	138,450,897	.....
Miami†	.....	2,890,000	3,097,500	2,688,000	2,862,050
Shattuck-Arizona	1,059,625	1,019,388	1,001,634	1,163,237	993,224
Brit. Col. Cos.:					
British Col. Cop.	634,238	618,379	647,905	621,120	.....
Granby	1,789,000	1,664,102	1,847,344	1,824,659	1,718,258
Mexican Cos.:					
Boleo†	1,984,640	2,240,720	2,264,640	2,369,920	.....
Cananea	2,908,000	3,328,000	3,186,000	3,148,000	3,682,000
Moctezuma	3,438,793	2,693,006	3,542,047	3,024,121	3,178,136
Other Foreign:					
Braden, Chile	1,804,000	1,046,000	1,572,000	1,332,000	2,006,000
Cape Cop., S. Af.	414,400	.....	.....	607,040	712,320
Kyshtim, Russia	1,000,000	2,500,000	1,585,000	.....	.....
Spassky, Russia	835,520	660,800	1,048,320	1,025,920	.....
Exports from					
Chile	5,824,000	9,856,000	8,736,000	5,600,000	6,160,000
Australia	7,616,000	10,304,000	7,720,000	6,944,000	7,728,000
Arrivals-Europe‡	5,277,440	11,728,640	14,624,960	9,661,120	18,040,960

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister. From May 1, Miami copper is refined in the U. S. and appears under American mines. From July 1 Miami ore went back to Cananea.

‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

Month	United States: U.S. Refin'y Production	United States: Deliveries, Domestic	United States: Deliveries, for Export	Visible Stocks: United States	Visible Stocks: Europe	Visible Stocks: Total
X, '12	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year: 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII	138,074,602	58,904,192	78,480,071	52,814,606	71,904,000	124,808,606
VIII	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,694
XI	.....	.....	.....	32,566,382	48,787,200	81,353,582

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq.	Sale	Amt.
Atlantic, Ida	Nov. 3	Dec. 2	0.0005
Beaver Copper, Utah	Nov. 12	Dec. 2	0.005
Belcher, Nev	Nov. 12	Dec. 4	0.10
Coeur d'Alene Invest., Ida	Nov. 7	Dec. 8	0.003
Colusa, Ida	Nov. 10	Dec. 2	0.005
Copper Chief, Ida	Nov. 10	Dec. 6	0.0025
Deer Trail, Utah	Nov. 3	Dec. 3	0.0075
Eagle Mountain, Ida	Nov. 18	Dec. 6	0.0005
Empire, Ida	Oct. 20	Dec. 1	0.005
Giant, Ida	Nov. 1	Dec. 4	0.003
Globe Cons., Utah	Nov. 6	Nov. 28	0.001
Gold Bond, Utah	Nov. 10	Nov. 24	0.001
Hider-Nevada, Nev	Nov. 17	Dec. 6	0.02
Lead-Bullion, Utah	Nov. 5	Nov. 26	0.004
Lehi Tintic, Utah	Nov. 5	Nov. 29	0.0025
Little North Fork, Ida	Oct. 8	Dec. 1	0.001
North Star, Ida	Nov. 10	Nov. 29	0.001
Rarus, Utah	Nov. 8	Nov. 29	0.001
Rhode Island, Ida	Sept. 26	Nov. 28	0.0005
Rochester, Utah	Nov. 7	Nov. 29	0.0025
Ruby Hill, Utah	Nov. 1	Dec. 6	0.005
St. Mary's, Utah	Oct. 20	Nov. 20	0.02
Tonopah, Gypsy Queen	Oct. 20	Nov. 24	0.01
Utah First National, Utah	Nov. 17	Dec. 3	0.001
Utopia Quicksilver, Calif			0.015
Wonder of Pine Creek, Ida	Nov. 3	Dec. 3	0.001

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	59.490	24.595	27.284	27.416
May	53.308	60.880	60.361	24.583	28.038	27.825
June	53.043	61.290	58.990	24.486	28.215	27.199
July	52.630	60.654	58.721	24.286	27.919	27.074
August	52.171	61.606	59.293	24.082	28.375	27.335
September	52.440	63.078	60.640	24.209	29.088	27.986
October	53.340	63.471	60.793	24.594	29.299	28.083
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver, London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	14.713	14.868	14.930	65.884	65.329
April	15.741	15.291	15.930	15.565	70.294	68.111
May	16.031	15.436	16.245	15.738	72.352	68.807
June	17.234	14.672	17.443	14.871	78.259	67.140
July	17.190	14.190	17.353	14.563	76.636	64.166
August	17.498	15.400	17.644	15.904	78.670	69.200
September	17.508	16.328	17.698	16.799	78.762	73.125
October	17.314	16.337	17.661	16.913	76.389	73.383
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	42.962	48.766	195.036	220.140
March	42.577	46.832	192.619	213.615
April	43.923	49.115	200.513	224.159
May	46.063	49.038	208.830	224.143
June	45.815	44.820	205.863	207.208
July	44.519	40.260	202.446	183.511
August	45.857	41.582	208.351	188.731
September	49.135	42.410	223.762	193.074
October	50.077	40.462	228.353	184.837
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3.946	4.175	15.738	16.550
March	4.073	4.327	4.046	4.177	15.997	15.977
April	4.200	4.381	4.118	4.242	16.331	17.597
May	4.194	4.342	4.072	4.226	16.509	18.923
June	4.392	4.325	4.321	4.190	17.588	20.226
July	4.720	4.353	4.603	4.223	18.544	20.038
August	4.569	4.624	4.452	4.550	19.655	20.406
September	5.048	4.698	4.924	4.579	22.292	20.648
October	5.071	4.402	4.894	4.253	20.630	20.302
November	4.615	.....	4.463	.....	18.193	.....
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	5.641	6.483	5.491	25.644	25.313
May	6.679	5.406	6.529	5.256	25.790	24.583
June	6.877	5.124	6.727	4.974	25.733	22.143
July	7.116	5.278	6.966	5.128	26.174	20.592
August	7.028	5.658	6.878	5.508	26.443	20.706
September	7.454	5.694	7.313	5.544	27.048	21.148
October	7.426	5.340	7.276	5.188	27.543	20.614
November	7.371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17.53
April	15.13	17.90	13.90	16.71	14.15	16.40
May	15.14	17.68	13.90	15.80	14.12	15.40
June	15.15	17.14	14.11	15.40	14.22	15.10
July	15.15	16.31	14.38	15.13	14.38	14.74
August	15.43	16.63	14.90	15.00	14.85	14.88
September	16.86	16.65	16.03	15.04	15.63	14.93
October	17.90	16.60	17.18	14.61	17.22	14.80
November	18.07	.....	17.09	.....	18.00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS Nov. 18

Name of Comp.	Bid.
Acacia	.02¾
Cripple Cr'k Con.	.01
C. K. & N.	.08¾
Doctor Jack Pot	.05½
Elkton Con.	.51
El Paso	2.75
Findlay	.02
Gold Dollar	.07½
Gold Sovereign	.02½
Golden Cycle	2.00
Isabella	.08½
Jack Pot	.04½
Jennie Sample	.04
Jerry Johnson	.03½
Lexington	.03
Old Gold	.01½
Mary McKinney	.55½
Pharmacist	.01½
Portland	.95½
Vindicator	.77

SALT LAKE Nov. 18

Name of Comp.	Bid.
Beck Tunnel	.04
Black Jack	.07
Cedar Talisman	.00½
Colorado Mining	.10
Columbus Con.	‡.01
Crown Point	.00½
Daly-Judge	5.05
Grand Central	.49
Iron Blossom	1.12½
Little Bell	.15
Lower Mammoth	.01½
Mason Valley	3.50
May Day	.04½
Nevada Hills	.45
New York	‡.02½
Prince Con.	.24
Silver King Coal'n	3.50
Sioux Con.	.01
Uncle Sam	‡.03½
Yankee	.06

TORONTO Nov. 18

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	.06½	Foley O'Brien	.16
Coniagas	7.15	Hollinger	17.87½
T. & Hudson Bay	64.00	Imperial	‡.02
Timiskaming	.13½	Jupiter	.08
Wettlaufer-Lor.	.07½	Pearl Lake	.10
Apex	‡.01	Porcu. Gold	.09
Big Dome	10.00	Preston E. D.	.03
Crown Chartered	‡.00¾	Rea	.10
Doble	‡.10	Swastika	.02
Dome Exten	.07½	West Dome	.05

SAN FRANCISCO Nov. 18

Name of Comp.	Bid	Name of Comp.	Bid
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.06	Belmont	7.50
Belcher	.30	Jim Butler	.73
Best & Belcher	.04	MacNamara	.09
Caledonia	1.75	Midway	.38
Challenge Con.	.11	Mont.-Tonopah	.90
Chollar	.04	North Star	.45
Confidence	.35	West End Con.	1.27½
Con. Virginia	.12	Atlanta	.10
Crown Point	.26	Booth	.02
Gould & Curry	.03	C.O.D. Con.	.03
Hale & Norcross	.07	Comb. Frac.	.04
Mexican	1.30½	Jumbo Extension	.08
Occidental	.70	Pitts.-Silver Peak	.38
Ophir	.21	Round Mountain	.36
Overman	.30	Sandstorm Kendall	.07
Potosi	.03	Silver Pick	.03
Savage	.11	Argonaut	3.00
Sierra Nevada	.07	Bunker Hill	2.00
Union Con.	.12	Central Eureka	.20
Yellow Jacket	.30	So. Eureka	‡2.00

N. Y. EXCH. Nov. 18

Name of Comp.	Clg.
Amalgamated	70¾
Am. Agri. Chem.	42
Am.Sm.&Ref.,com.	63½
Am. Sm. & Ref., pf.	99½
Am. Sm. Sec., pf. B	81½
Anaconda	34½
Batopilas Min.	.75
Bethlehem Steel,pf.	69
Chino	38½
Federal M. & S., pf.	37
GreatNor.,ore.,ctf.	32¾
Guggen. Exp.	43½
Homestake	109½
Inspiration Con.	14½
Miami Copper	21½
Nat'l Lead, com.	43½
National Lead, pf.	104½
Nev. Consol.	14½
Phelps Dodge	188
Pittsburg Coal, pf.	87½
Quicksilver, pf.	3
Ray Con.	17⅞
Republic I&S,com.	18¾
Republic I&S, pf.	79¼
SlossSheffi'd,com.	27
Sloss Sheffield, pf.	86
Tennessee Copper	28¾
Utah Copper	48⅞
U. S. Steel, com.	55⅞
U. S. Steel, pf.	105¾
Va.Car.Chem.,pf.	92

N. Y. CURB Nov. 18

Name of Comp.	Clg.
Ariz. Belmont	.04½
Barnes King	1⅞
Beaver Con.	.33
Big Four	.10
Braden Copper	6¼
B. C. Copper	2¼
Buffalo Mines	1⅞
Can. G. & S.	.15
Caribou	.60
Con. Ariz. Sm.	.25
Coppermines Cons.	2 7/16
Davis-Daly	1⅛
Diam'field-Daisy	.03
Ely Con.	.02½
Florence	.20
Gold Hill Con.	3/16
Goldfield Con.	1 7/16
Greene Cananea	30
Greenwater	.04
Internat. S. & R.	‡115
Kerr Lake	4⅛
La Rose	1 1/16
McKinley-Dar-Sa.	1¼
Min. Co. of A. new	2
New Utah Bingham	.50
Nipissing Mines	8⅛
Ohio Copper	7/16
Pacific Sm. & M.	‡1
Puebla S. & R.	2¾
South Utah M&S.	1/16
Stand'd Oil of N.J.	379½
Stewart	1 5/16
Tonopah	4 13/16
Tonopah Ex.	1 5/16
Tonopah Merger	.59
Tri-Bullion	1/16
Tularosa	1/16
Union Mines	‡.08
United Cop., pfd.	3
Yukon Gold	2 1/16

LONDON Nov. 10

Name of Comp.	Clg.
Camp Bird	£0 14s 0d
El Oro	0 14 0
Esperanza	0 15 0
Mexico Mines	5 5 0
Oroville	0 7 3
Santa Gert'dis	0 17 6
Stratton's	0 1 0
Tomboy	1 6 3

BOSTON EXCH Nov. 18

Name of Comp.	Clg.
Adventure	1¼
Ahmeek	‡273
Alaska Gold M.	20½
Algomah	1
Allouez	33
Am. Zinc	16½
Ariz. Com., ctfs.	4¼
Bonanza	.41
Boston & Corbin	.60
Butte & Balak	4½
Calumet & Ariz.	62½
Calumet & Hecla	405
Centennial	12½
Cliff	‡1
Copper Range	36½
Daly West	2½
East Butte	10½
Franklin	3
Granby	70
Hancock	13½
Hedley Gold	30
Helvetia	.25
Indiana	3
Island Cr'k, com	47½
Island Cr'k, pfd	82
Isle Royale	‡17
Keweenaw	2¼
Lake	6½
La Salle	3¼
Mass	2
Michigan	.75
Mohawk	40
New Arcadian	1½
New Idria Quick	2¼
North Butte	23½
North Lake	1
Ojibway	.75
Old Dominion	48½
Osceola	73½
Quincy	55¼
Shannon	6¼
Shattuck-Ariz.	26
Superior	22½
Superior & Bost.	2½
Tamarack	27
Trinity	4½
Tuolumne	.80
U. S. Smelting	37
U. S. Smelt'g, pf.	46¼
Utah Apex	1¼
Utah Con.	8
Victoria	1¼
Winona	1½
Wolverine	42
Wyandot	.50

BOSTON CURB Nov. 18

Name of Comp.	Bid
Bingham Mines	5
Boston Ely	.45
Butte&Lon'nDev.	.33
Cactus	.02
Calaveras	1¼
Chief Cons.	1 1/16
Corbin	1
Cortez	.20
Crown Reserve	1 1/16
Eagle & Blue Bell	.90
First Nat. Cop.	2 1/16
Houghton Copper	2¼
Majestic	.25
Mexican Metals	.45
Moneta Porc.	‡.07
Nevada-Douglas	1¼
New Baltic	.50
Oneco	.80
Raven Copper	.69
Rhode Island Coal	.01
Smokey Dev.	.50
So. Lake	2¼
S. W. Miami	‡1¼
Tonopah Victor	.35
Trethewey	.30
United Verde Ext.	.40

‡Last Quotation.